Preliminary

PLANT ASSOCIATIONS and HABITAT TYPES of the Snoqualmie and adjacent Skykomish River Drainages Mt. Baker - Snoqalmie N. F.

USDA • Forest Service
Pacific Northwest Region

PRELIMINARY PLANT ASSOCIATIONS AND HABITAT TYPES OF THE SNOQUALMIE AND ADJACENT SKYKOMISH RIVER DRAINAGES MT. BAKER-SNOQUALMIE NATIONAL FOREST

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PREFACE

This document represents the first approximation toward a comprehensive vegetation-site classifi-ation for this area. Organization and naming of the types should be viewed as tentative until field checking of keys and quantitative verification of types is completed. Preliminary results are presented in this form as a working tool in the process of development of the Area Guide. Feedback on the clarity of the key and type descriptions to the author is welcome.

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INTRODUCTION

Vegetation is the major resource land managers manage. It covers 99% of the land and provides many resource values. It is the source of food and cover for livestock and wildlife. Timber comes from the trees of the Forest. Spiritual, recreational and esthetic values come from the majestic forests, scenic meadows and lakes and streams. Besides these direct values, it serves to hold the soil mantle in place, thereby indirectly enhancing some of these same values. It is easily manipulated and sensitive to natural catastrophes. Yet we know relatively little about it, its ecology or the ecological implications of its management.

What kinds of vegetation are there? Where do they occur? How sensitive are they? Are they equally suitable for deer or elk or sheep habitat? How do they respond to management treatment? How fast do they grow or regrow? Which plants or animals can be found where? The answers to these questions are tied up in the complex distribution patterns of plant communities and their interactions with the environment. In order to answer these questions in a way that will satisfy sophisticated managers as well as meet the considerable load of regulations imposed on land managers today, a system is needed which helps deal with the vegetational patterns, helps us understand the complex ecosystem interactions and provides a way to apply ecological knowledge for better management.

A beginning to the solution of these problems is the description of "kinds of vegetation" in a way that is both logical and natural and will help us communicate with each other about what we need and what we know.

Forest Cover Types and Range Sites have served partially to fill this need as have various vegetation or life-zone classifications. These are single-use classifications that fail to serve a wide need or are too broad to be of much use in land management. In fact, probably no single vegetation or ecosystem classification scheme will suffice by itself. We need a system for classifying and describing vegetation that is internally compatible and meets the functional needs of managers.

The first step in addressing these questions is a classification and description of the potential vegetation of an area. (Daubenmire and Daubenmire 1968; Hall 1970, 1973; Franklin and Dyrness 1973; Pfister et al. 1975). The potential (or projected climax) vegetation is in greatest equilibrium with its environment and is relatively stable. It is the most easily determined stage of successional development to which all other vegetation, regardless of stage or degree of disturbance can be related. It is a reference point. It is the first step in trying to bring order to an otherwise bewildering mosaic of vegetation and vegetation-environment interactions. The basic unit of the potential vegetation is the Plant Association.

STUDY AREA

The area covered by this classification includes the Snoqualmie River drainage system of the North Bend Ranger District and adjacent lands of the Skykomish River system south of the Stevens Pass Highway (US-2) on the Skykomish Ranger District (Figure 1). This area covers about 250,000 acres (102,000 ha) of which about 81% or 204,000 acres (83,000 ha) are Forest Service lands. Of the Forest Service lands in this area 20,000 acres (8,000 ha) belong to the western hemlock zone; 31% or 63,000 acres (25,000 ha) belong to the silver fir zone; 40% or 82,000 acres (33,000 ha) belong to the mountain hemlock zone; and 19% or 40,000 acres (16,000 ha) are non-forest meadows, lakes, glaciers or bare rock. Also, one plot was sampled in the Middle Fork of the Snoqualmie which represents an outlier of the Sitka spruce zone.

The area is dominated by the Alpine Lakes Wilderness Area. It is rugged and poorly roaded. Numerous trails facilitated access to much of the area. Cross county travel was necessary through parts of the area. Backcountry recreational use is heavy while logging and timber management activities are localized in the few suitable areas, notably along the Snoqualmie Pass corridor, in the North Fork of the Snoqualmie River and in the Tonga Ridge area.

Some of the area was railroad logged in the earlier part of this century. Much of the Western hemlock zone in the Middle Fork of the Snoqualmie River was logged in this way. Much of the rest of it is in undisturbed old-growth condition. The high precipitation characteristic of the area has resulted in a low frequency of fires over the long run and therefore most of these communities are believed to be older than the age of the oldest trees. This makes sampling for plant Association descriptions particularly favorable but sampling for site index and other timber productivity indices more difficult.

Climate is generally wet and cool, especially near the core of the area.

The fringes, along the north, west and south are drier and support some of the more typical drier site communities characterized by such species as salal, beargrass, thinleaf huckleberry and noble fir. The large granite mountain mass at the core of this area has a profound effect on the climate of this area, increasing the precipitation, lowering temperatures and lowering the elevation of vegetation zones in this area (See Figures 2 & 8).

The bedrock of this area is primarily granite and granite-like rocks with some andesite and meta-sedimentary rocks around the drier fringes. Pleistocene glaciation has left its mark on many high elevation ridges. There are many cirque basins in the area, many of these contain tarns or even large glacial lakes.

Topography is mostly steep, with the effects of the glacial history usually apparent. Elevations vary from about 800 feet (244 m) in the lower Skykomish Valley to Chimney Rock at 7727 feet (2355 m).

Most elevations are above 2,000 feet (610 m) and below 5,000 feet (1524 m).

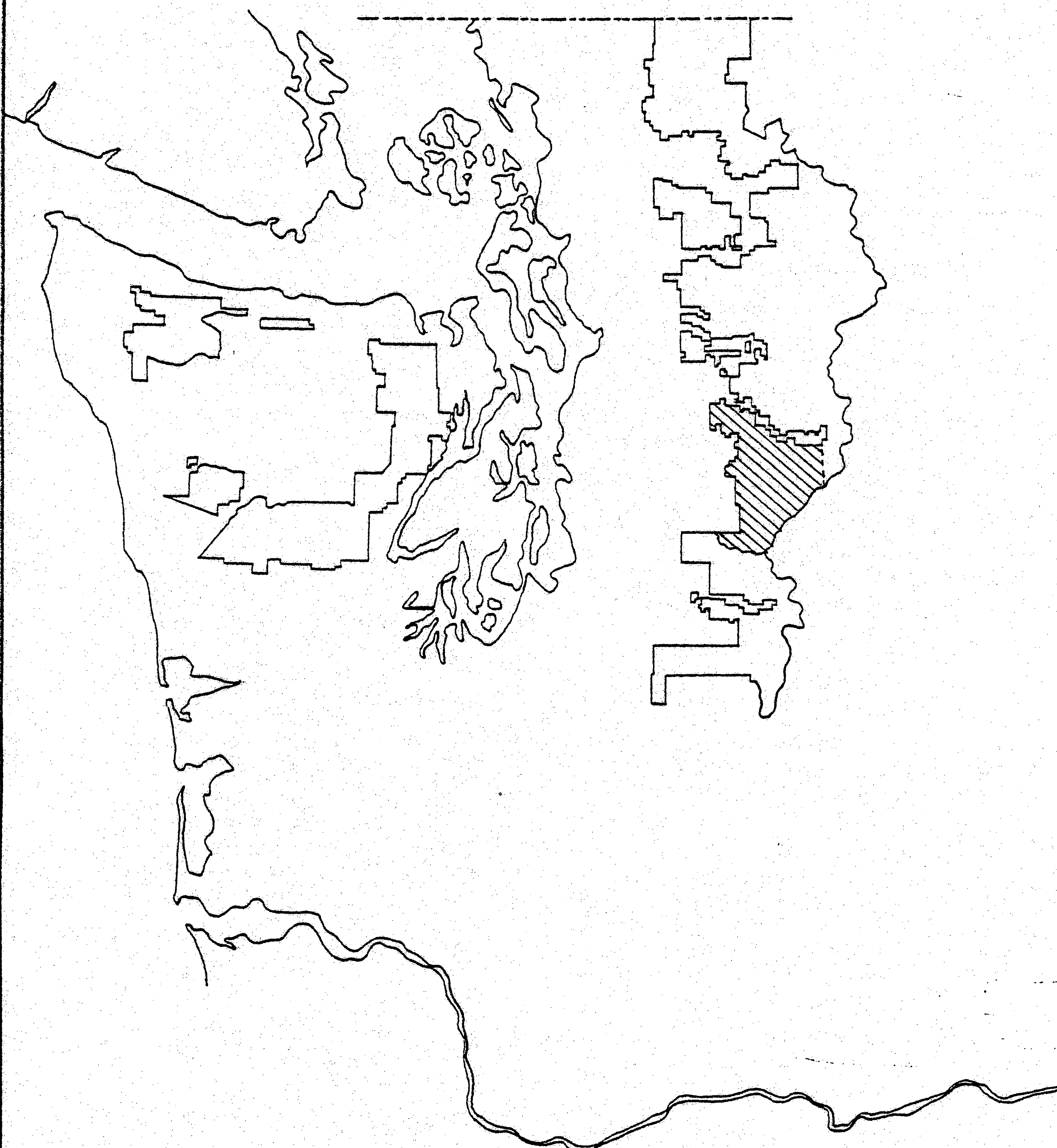

Figure 1. Map of Western Washington, Study Area Shaded.

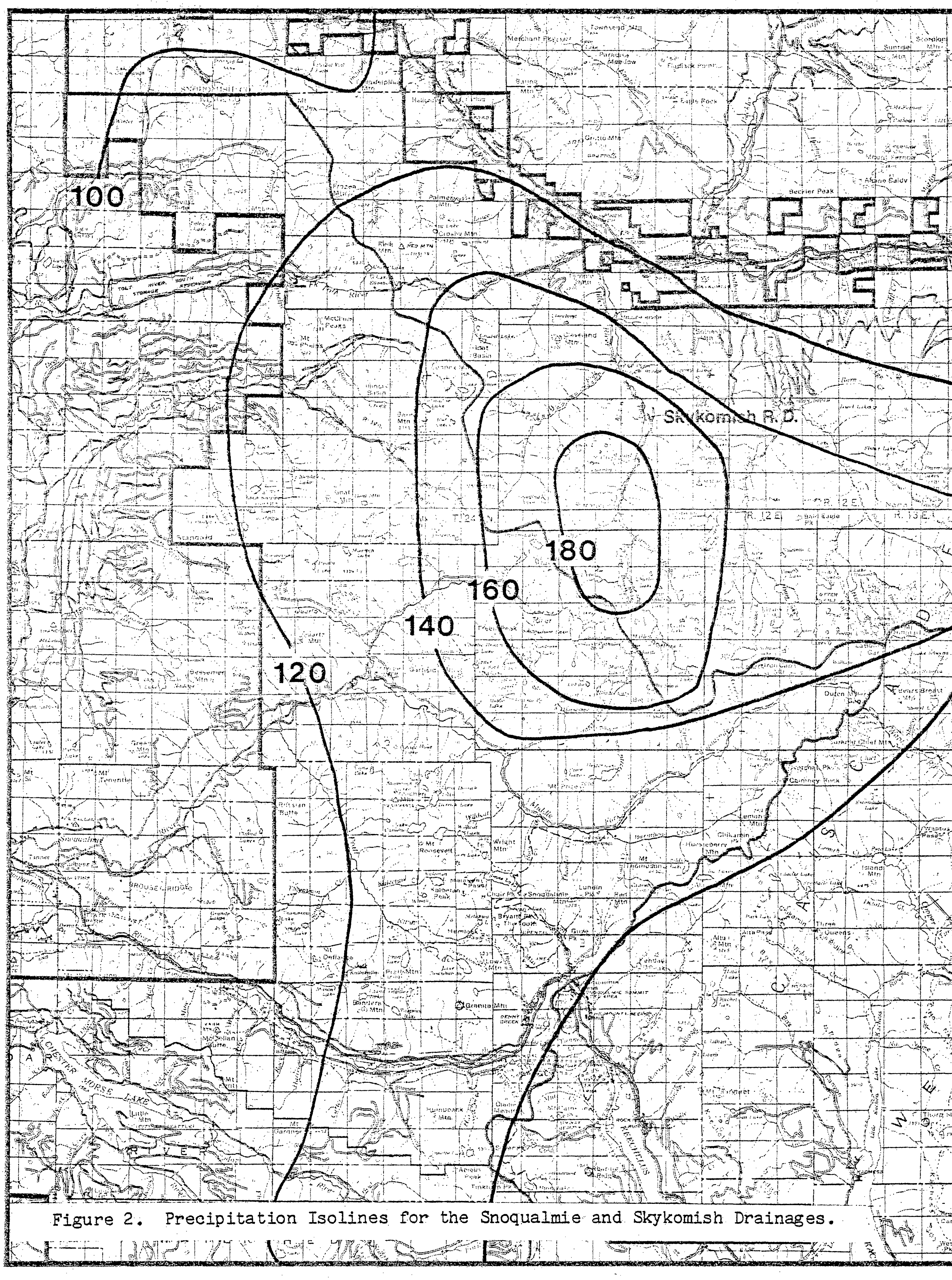

Figure 2. Precipitation Isolines for the Snoqualmie and Skykomish Drainages.

ECOLOGICAL PERSPECTIVE

Vegetation occurs over the landscape as a complex mosaic of various communities in different stages of development or disturbance and each responding to the gradients of environmental conditions (e.g., soil, climate, topography, temperature, etc.). Each community is the product of a different combination of environmental, biotic and historic factors.

It is this mosaic of plant communities which we manage. The complexity of these biotic, abiotic, and historical factors is so great we have only really begun to unravel the pattern and the process.

Even if the effects of disturbance could be eliminated and all communities allowed to develop to the point where they are believed to be in equilibrium with the environment (climax?), the vegetation would still probably represent a continuum of communities when measured along a uniform environmental gradient over large distances. However, for any geographical area (in the western U.S. at least) environmental gradients are not uniform, and in fact marked discontinuities are common, with certain combinations of environmental factors occurring in the landscape more frequently than others. The segments of the vegetational continuum associated with those environmental "combinations" also occur more frequently. Therefore, although we recognize the continuum nature of vegetation, we analyze and portray it as natural segments or "types".

These we call community types, or Associations. If we are dealing with or analyzing seral communities or communities for which the end point of succession (climax) is unknown or cannot be projected we use the community type concept. If we are referring to the projected climax potential of a community, we refer to it as an Association. This is not to be misunderstood that we believe that these types are sacred or even inherent units of the vegetation. We view these "types" as somewhat arbitrary but statistically derived segments of the vegetational continuum for this area.

The typal approach allows us to break up a very complex array of plant communities into more understandable units. Such units can then be used to communicate with others, to catalog and store information about the vegetation (such as productivity, regeneration response, etc.) stratify the vegetation and the landscape into relatively homogeneous units for the purposes of other studies (such as potential timber productivity, fertilizer response or successional patterns) or to aid in the study of the relationships between vegetation and the physical environment.

The distinction between the existing vegetation (community types) and the potential (Associations) is fundamental to the approach used in this study. The existing vegetation is what we manage. However, to understand the potentials of a particular community and to understand its relationship to the physical environment (the forces that drive the ecosystem), the existing community must be related to some reference point in time. Preferably this reference point (successional or developmental stage) will be in relatively stable equilibrium with its environment. The one successional stage that does this is the "climax" stage. We do not know for sure what the climax stage is for a community or for an area because of problems of time scale, climatic changes and fire. We

discount the effects of fire, assume that climatic changes are insignificant (poor assumption at high elevations) and that the community which could develop in a time frame of about 1000 years represents the "Climax". We do not have an abundance of 1000 year old communities to sample. Therefore, we use the projected climax potential as an estimate of the climax stage. To do this we project the relative abundance of trees ahead in time to about 1000 years using stand conditions in the oldest sampled communities and knowledge of the tolerance of trees. Secondly we assume that the understory (ground vegetation) component has come to equilibrium with the environment by about 200 years. Therefore, the understory component of all communities sampled which are 200 years or older can be used in analyzing and describing the Association (Projected Climax community type).

CLASSIFICATION HIERARCHY

The classification hierarchy used in delineating and defining units of vegetation (potential and actual) and units of land with similar ecological characteristics is intended to be the same that is being proposed for national usage by the interagency Resources Evaluation Team (RET).

The classification hierarchy emphasizes potential vegetation at the level of the Plant Association as the basic unit. Plant Associations are abstract units of the potential vegetation which are characterized by the same overstory and understory dominants. Phases are finer subdivisions of the Association based on secondary or indicator species, and Series are aggregations of Associations with the same overstory dominants. Kuchler's Potential Vegetation Types (KPVT's) are equivalent to mapped series or groups of ecologically similar series. Regional formations (Biomes) are the next highest level above series in the currently proposed national classification.

The aggregate of all units of land capable of supporting a single plant Association (at climax or stable-state) is called a Habitat Type. A Habitat Type is named for the Plant Association which characterizes it and may also have phases named for the Association phase.

Ecological Land Units (or Ecological Response Units) are areas of land with similar responses to treatment and reactions to the environment and are at least partially defined and delineated on the basis of the Habitat Type.

In addition to the potential vegetation types, it is also useful to recognize plant community types and plant communities. Plant communities are the actual entities which occupy the landscape. The plant community type is an abstract aggregation of similar communities which may or may not reflect their successional condition. However, a climax community type is considered synonymous with Plant Association. The classification hierarchy is outlined in Figure 3.

Higher levels in the National (RET) classification system

SERIES – Associations are aggregated into series to aid in keying and cataloguing the Associations.

ASSOCIATION – The basic abstract unit in the potential vegetation classification system.

PHASE – Associations are subdivided into Phases to meet the needs for finer resolution and applications for management.

PLANT COMMUNITY TYPES – When sampled in the landscapes they represent the seral stages leading to the development of the climax successional stage (Association).

ZONES – The land area where a single series is dominant under stable or climax conditions.

HABITAT TYPE – The land area capable of supporting a single Association.

Habitat type PHASES – are land units capable of supporting a single Phase of an Association.

ECOLOGICAL LAND UNITS – Integrations of Habitat Types and phases with certain physical attributes of the environment (e.g., soil, climate and land form) to provide units of the landscape with similar responses to treatment.

Figure 3. The classification hierarchy. The basic potential vegetation hierarchy runs diagonally from upper left to lower right, with the "habitat" type hierarchy paralleling and above.

FIRE AND OTHER DISTURBANCE HISTORY

The analysis of fire history done for other areas (Henderson and Peter 1981a, c) was based on sampling of known pioneer species such as Douglas-fir and noble fir. Ages were accurately determined from stumps from recent clearcuts; and fire scars, preserved in these stumps were often found. The absence of Douglas fir and noble fir and recently cut stumps has not allowed a study of the fire history of this area as was done in drier or lower elevation areas.

Ages from increment coring and other indirect evidence suggests, however, that there have been few fires in this area in the past 1000 years. Parts of the far southern and northern areas were burned about 270 and 310 years ago; times when major conflagrations consumed hundreds of thousands of acres in western Washington. These fires apparently slopped over into the study area and burned mainly on the driest aspects and at lower elevations.

More recently, two areas have burned, worth noting. The Granite Mountain area has been the site of several major fires since settlement and probably numerous others before settlement. The Tonga Ridge-Mt Sawyer area burned sometime around the turn of the century. More precise dates of these fires will be determined at a later time.

Wind has apparently not been a significant perturbation over the long run, although pockets of wind throw are occasionally encountered.

Avalanches and mudslides are important, especially at high elevations and along some of the steep U-shaped glacial walls. Avalanches usually begin in non-forested areas in the mountain hemlock zone and often re-occur down well-established avalanche chutes. Hemstrom (1979) studied this disturbance factor in Mount Rainier National Park.

The long term development of the communities in this area, especially those at higher elevations has been affected by minor climatic fluctuations during the last 1000 years. The cooler episodes during this time have been referred to as the "little ice age".

Indirect evidence from glaciers, especially on Mount Rainier, sunspots, carbon-14 models and some direct climatic records indicate that cooler periods resulted in greater snow accumulations and glacial advances culminating about the years 1340, 1530, 1715 and 1810 AD. These "lobes" of the little ice age have had a significant effect on community dynamics, especially in the mountain hemlock and subalpine meadow zones.

Some estimates put the mean annual temperature as much as 3.5° F. (2°C) lower in about 1715 compared to today. This could have the effect of lowering the vegetation zone potential by over 1000 feet (305 m). The apparent change in elevation of timberline in the past 250 years corresponds with this observation but not to the magnitude of 1000 feet. Probably, there has been a more subtle change in temperature, say 0.5 - 1.0°F. (_ca_ 0.5°C) during this time and a rise in timberline of about 300 feet (100 m).

Analysis of tree ages in the subalpine zones shows that a major period of establishment has occurred since 1715, culminating during the warm dry spell during the 1930's (Franklin et al. 1971, Henderson 1974). Tree ages taken mainly in the Alpine Lakes Wilderness Area indicate that very few trees become established during the lobes of the little ice age.

From this evidence we can speculate that the mountain hemlock and subalpine meadow zones exist in a dynamic equilibrium, with advances and establishment of trees during warmer, interglacial periods, and retreat and possibly greater mortality of trees during the colder glacial periods.

We are now in a warmer period of expansion and tree invasion into meadow areas. One place to see this clearly is in the small basin at the east end of Snow Lake. Here, heather and huckleberry communities have been invaded by trees, mainly during the past 100 years. This is changing the gross physiognomy of the area from one of scattered tree islands with a mosaic of heather and huckleberry communities in between, to one of a more continuous forest. This area appears to be right at the present day forest line - meadow ecotone.

Only by speculation can one pretend to predict what might happen in the future. However, the evidence seems to indicate that we are heading toward another colder episode with glacial advances, greater snow accumulations and retreat of some communities from their present extent. The interval of past episodes suggests this could occur by the turn of the century.

SAMPLING PROCEDURES AND ANALYSIS

The vegetation was sampled using 500 m^2 reconnaissance plots. These plots were used to acquire data on vascular plant species presence and cover. The taxonomic authority used was Hitchcock et al. (1955-1969). Hitchcock and Cronquist (1973) was used for field identification. Data were also taken on the physical site features (slope, aspect, elevation, and topography) plus measures of stand structure, age and productivity. Plot locations were marked on topographic maps. Details of plot layout, coverage estimates and parameter codes are not presented here, but are available on request. In general, they follow the procedures used by Henderson 1974, Henderson et al. 1979, Franklin et al. 1979, and discussed in Franklin et al. 1970, and Henderson 1979.

Sampling was done to provide an adequate coverage of all areas, stand ages and vegetation types at an intensity of at least one plot per section of land (Figure 5). To do this, several sampling strategies were used. Initially, we tried to put one plot near the center of each section of land where road or trail access allowed. Since sampling of old-growth communities was the primary objective, often the most accessible stand of old-growth near the center of a section was used.

Where this sampling scheme was not feasible, road, trail or cross-country transects were used with a predetermined sampling interval (e.g., each 1/2 mile, 1/2 hour, or 300 feet elevation). Lastly, if this did not prove appropriate for the vegetation at hand, subjective bias was used to allow sampling of communities too small or irregular to be picked up in the other strategies. Also, plots were often established in clusters (most often as pairs) when it would be useful for subsequent analysis to show, for example, the vegetation on two or more contrasting aspects or to sample two or more different age classes contiguous or near enough to each other to represent the same kind of site.

The resulting sample of 253 plots in the study area (including 145 old-growth forest plots, 28 non-forest plots and 80 seral forest plots) represents a combination of systematic and subjective sampling strategies (Figure 4). The objective was to ensure optimum representation in the samples of the variability in vegetation in the area. This provided us with a sampling intensity of 1.1 plots/section in the western hemlock and silver fir zones and an intensity of .8 plots/section over all. Sampling was thus concentrated in areas having high timber management potential.

Identification of plant Associations used computer assisted sorting and clustering routines (Volland and Connelly 1978). Only old-growth and climax communities were used in this analysis. Association and similarity tables and cluster analysis dendrograms were generated to help group climax communities and projected climax communities into types. Each type being comprised of and characterized by communities with relatively homogeneous composition. Although several different approaches are used, and each one aggregates plots into clusters or types, they ordinarily do not completely agree. The final marrying of approaches becomes subjective and controlled largely by the biases and perspectives of the classifier. However, the objective is a classification of climax community types (Associations) with the greatest overall within class similarity, the greatest between type dissimilarity and the best application to management problems.

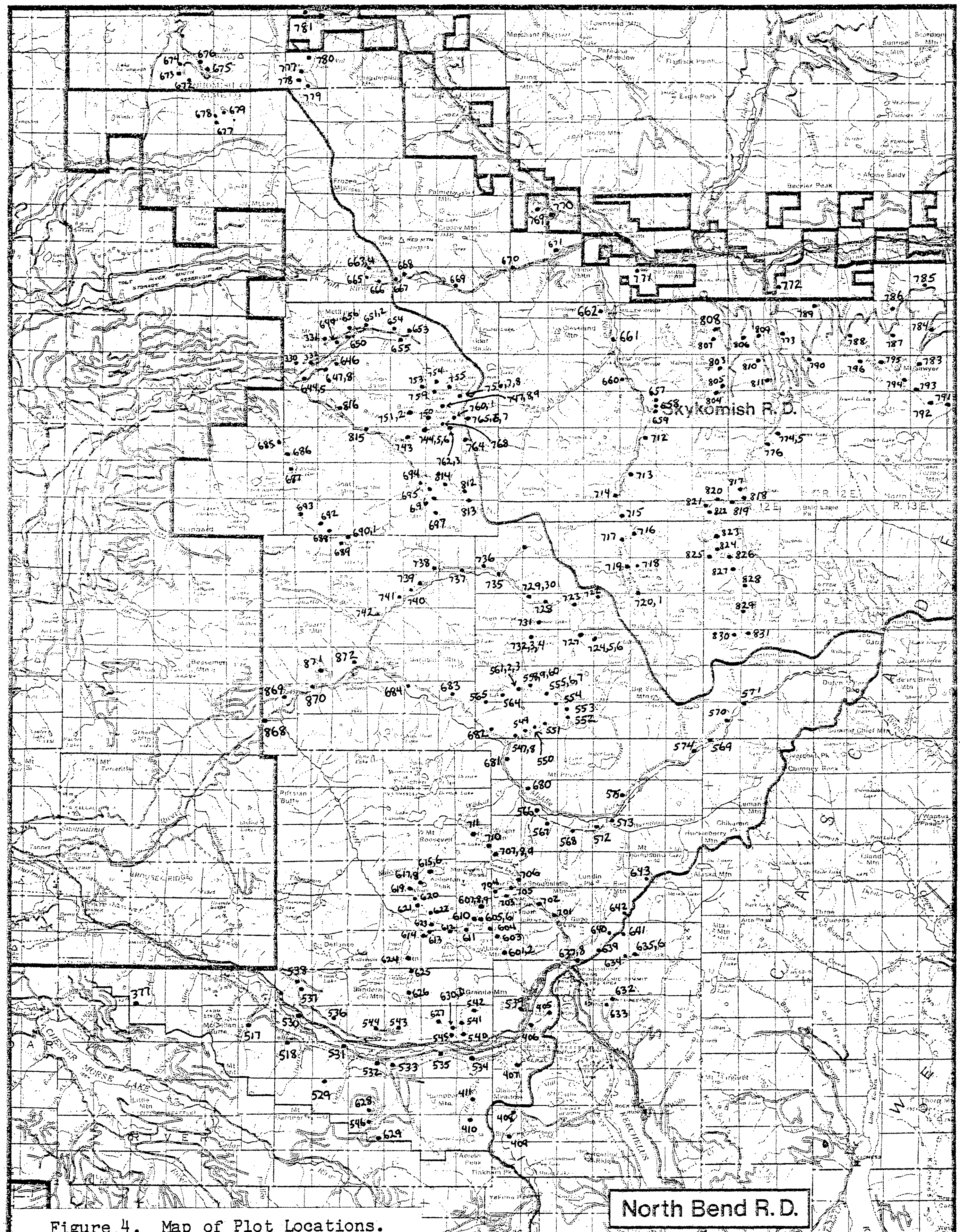

Figure 4. Map of Plot Locations.

THE FOREST SERIES

The first level in the classification hierarchy below the formation is the series. It is also the first level that is useful at the forest planning or project level.

Series are broad units of the potential (projected climax) vegetation which are identified by one (or more) dominant overstory species. In this area we recognize three Forest series - western hemlock, silver fir, and mountain hemlock. The area of ground where these series can occur are called zones and go by the same names, i.e. the western hemlock zone is the area where the western hemlock series is potentially dominant, etc.

Typically, in the near-climax state in temperate forest vegetation more than one tree species dominates. This is understood in naming a series even when we use a single tree species. For example, in the silver fir series western hemlock and silver fir will codominate. In the mountain hemlock zone, mountain hemlock and silver fir will codominate. The distribution and location of the western hemlock, silver fir and mountain hemlock zones are shown in Figures 6, 7, and 8.

Figures 6 and 7 shows the aspect-elevation relationships used to help construct the map of the zones in Figure 8. The aspect-elevation relationships vary relative to precipitation and general climatic patterns. These apply to the areas or zones shown in Figure 8. Curve 4, for example applies to the area shown in Figure 8 as "4", curve 6 applies to the area 6 etc. These figures show that the elevation of the vegetation zones gets higher in drier areas and lower in wetter areas.

The first step in identifying an Association or habitat type is to identify the series. The series name becomes the first part of the name of Association or habitat type just as the genus is the first part of the species name in plant taxonomy.

The following key will allow the user to identify the series. It can only be used on stands or communities for which the projected climax composition is known or can be estimated. Further interpretation is often necessary to apply this classification to seral (second growth) communities.

Key to the Forest Series

1. Mountain hemlock (Tsme) $\geq$ 10% cover in old-growth or projected climax condition. *Tsuga mertensiana* Series p. 20

1. Not as above. . . . . (2)

    2. Silver fir (Abam) $\geq$ 10% cover in old-growth or projected climax condition . . . . *Abies amabilis* Series p. 35

    2. Western hemlock (Tshe $\geq$ 10% cover in old-growth or projected climax condition. . . . . *Tsuga heterophylla* Series p. 50

TABLE I. Successional Role of Tree Species by Habitat Type

	Alru	Psme	Abpr	Tshe	Thpl	Abam	Chno	Tsme	Abla2
Tshe/Gash	+	S		C	c				
Tshe/Bene	s	S		C	c				
Tshe/Dep.	s	S		C	c				
Tshe/Pomu	S	S		C	c				
Tshe/Vaal	s	s		C	c	+			
Tshe/Opho	s	s		C	C	+			
Abam/Dep.		s	+	C	c	C			
Abam/Opho				C	c	C			
Abam/Vaal		s	+	C	+	C	+	+	
Abam/Vame		+	S	C		C	+	+	
Tsme/Vaal				+		C	c	C	
Tsme/Vame		+	s	+		c	+	C	s
Tsme/Dep.			+	+		c	c	C	s
Tsme/Clpy-Blsp						c	c	C	
Tsme/Rhal						+	+	C	
Tsme/Phem-Vade						+	+	C	s

Where: C = Major climax species S = Major seral species + = May occur
c = Minor climax species s = Minor seral species

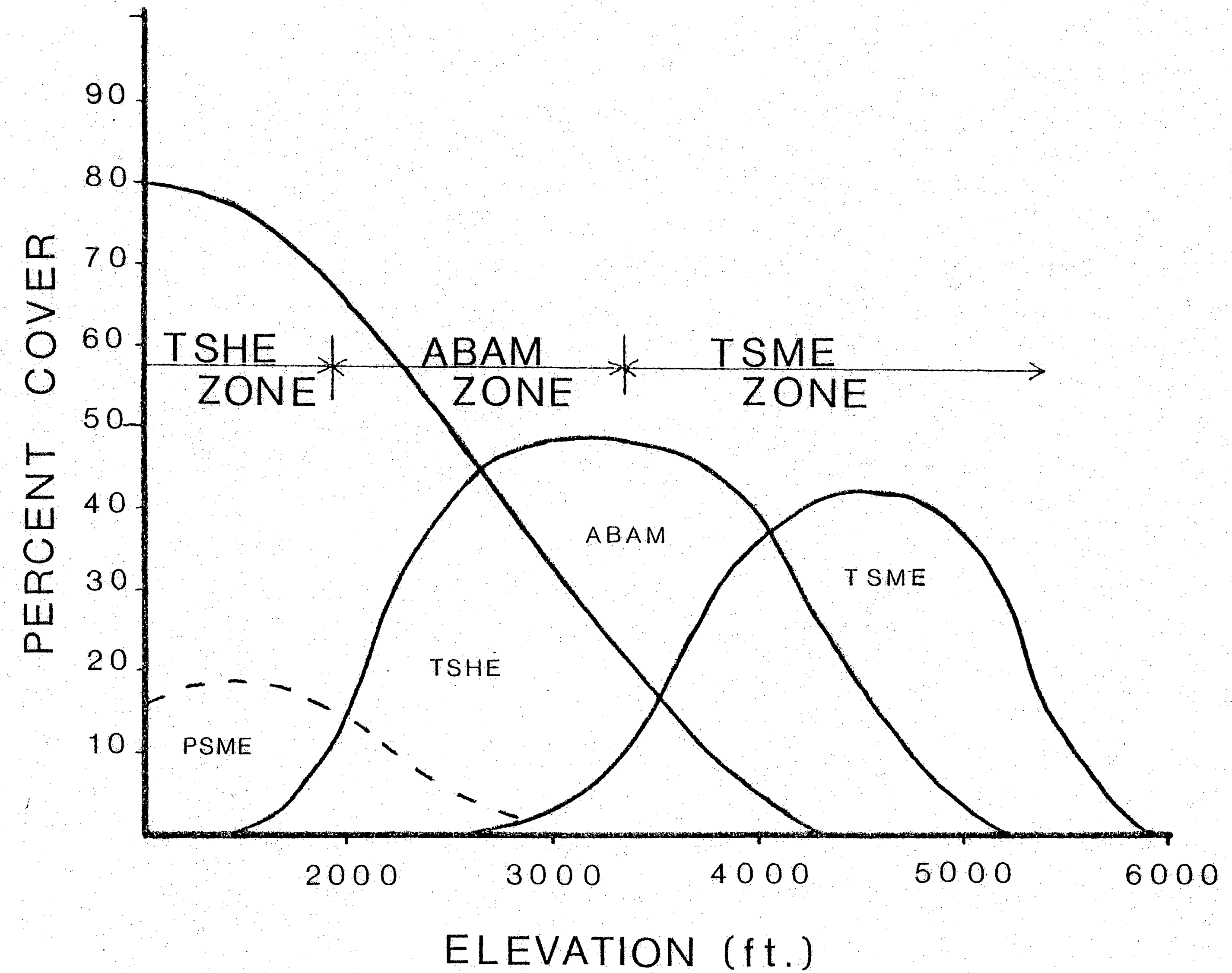

Figure 5. Elevational Distribution of Important Tree Species.

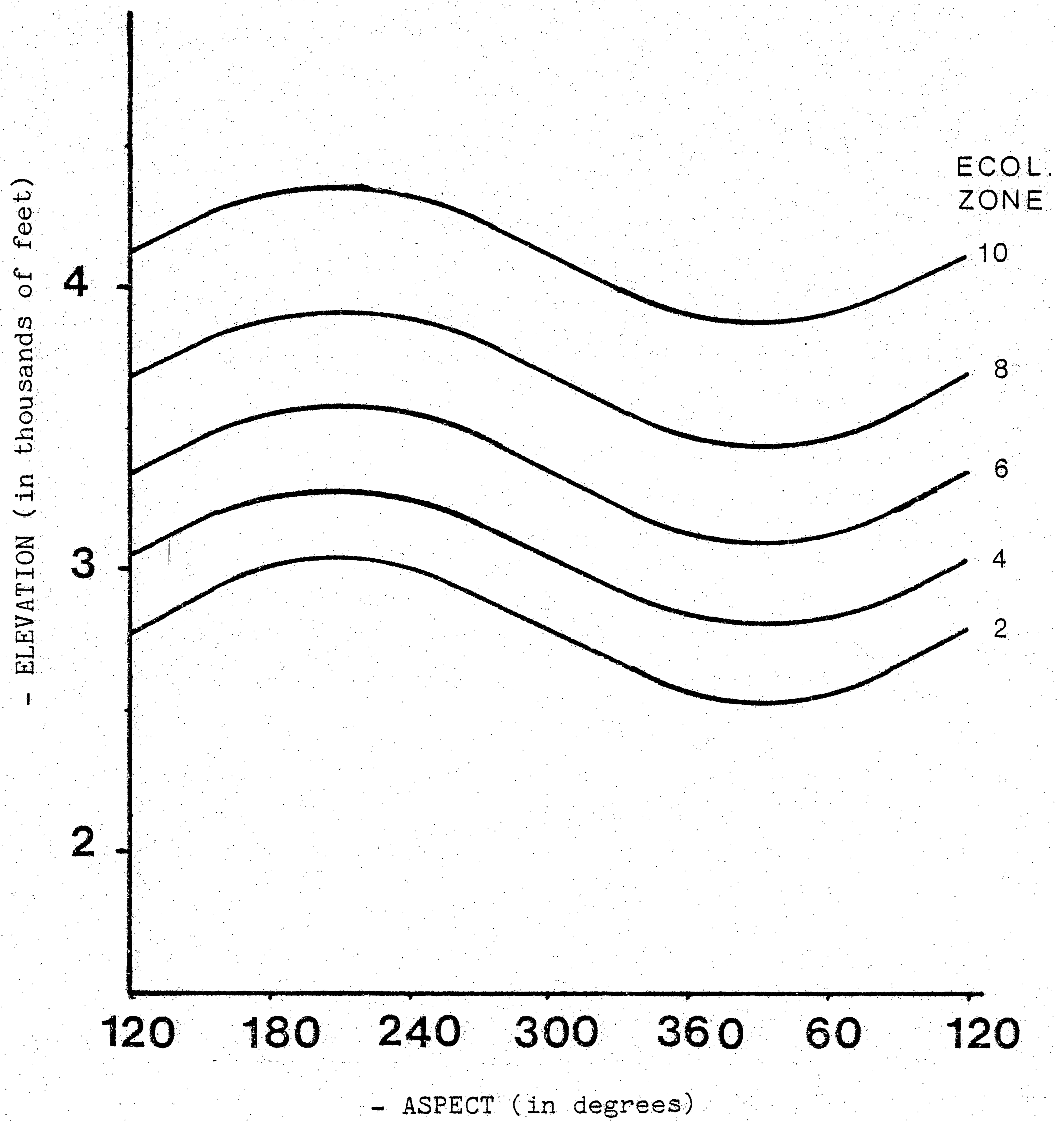

Figure 6. Aspect - Elevation Curves for the Upper Boundary of the <u>Abies amabilis</u> zone (Lower boundary of <u>Tsuga mertensiana</u> zone.) This series of curves in mathematical form is:

$$\text{Elev} = 3340 * \left[1 + \left(1 - \frac{\text{pptn}}{126}\right) \Big/ \frac{\text{pptn}}{60}\right] - 250\,[\cos(\text{aspect} - 30)]$$

$$+ [(5 - \text{MI})(130)]$$

see fig. 7 for explanation of symbols

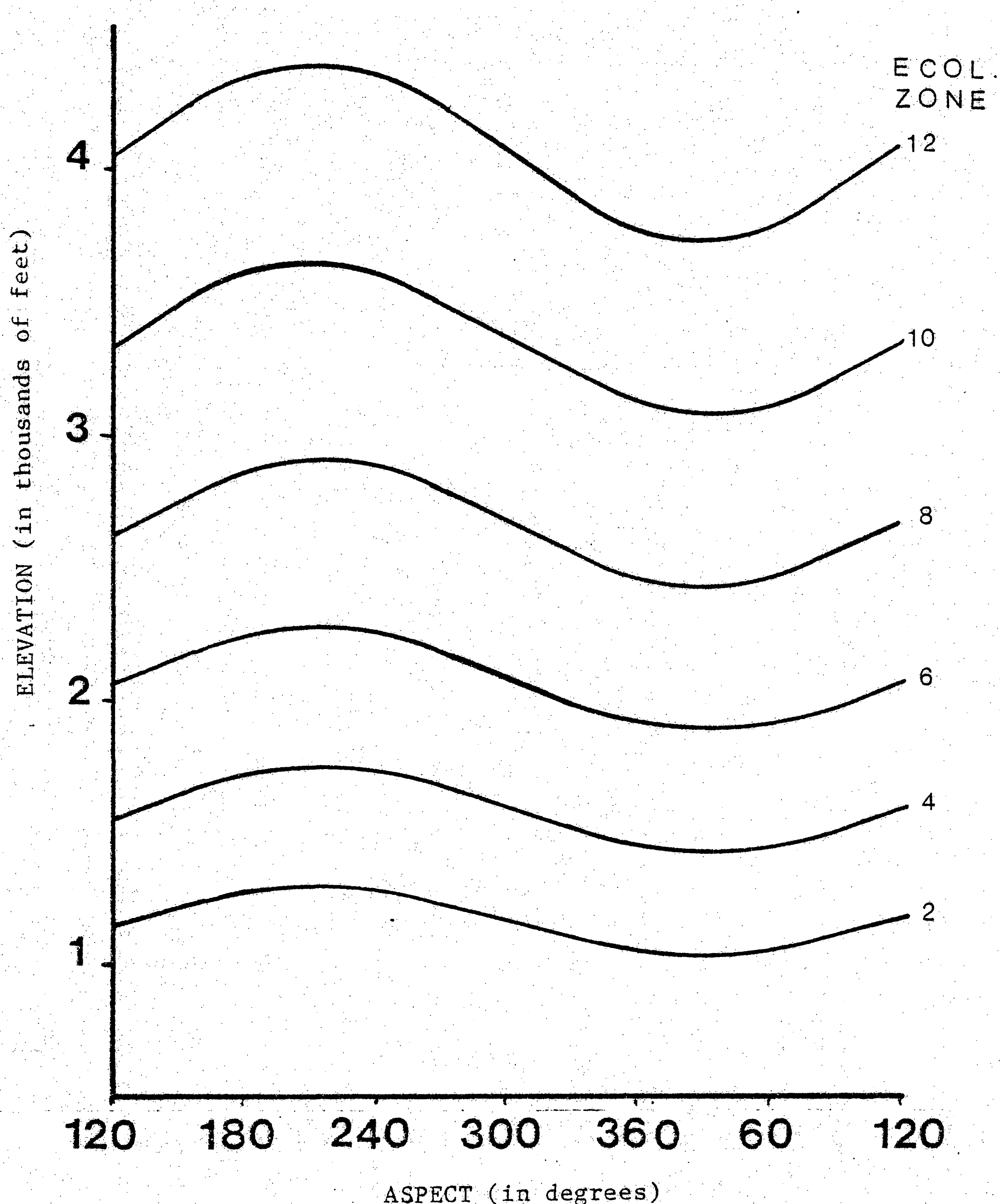

Figure 7 . Aspect-Elevation curves for the lower boundary of the Abies amabilis zone (upper boundary of the Tsuga heterophylla zone. This series of curves in mathematical form is:

$$\text{Elev} = 2080 * \left[1 + \left(1 - \frac{\text{pptn}}{126} \right) \Big/ \frac{\text{pptn}}{160} \right] -$$

$$[\cos(\text{aspect} - 30)(25000/\text{pptn})] + [(5 - \text{MI})(130)]$$

where Elev = elevation in feet
pptn = precipitation in inches, includes fog drip of up to 50"
Aspect = aspect in degrees
MI = topographic moisture index where
1 = very dry, 5 = modal, 10 = very wet.

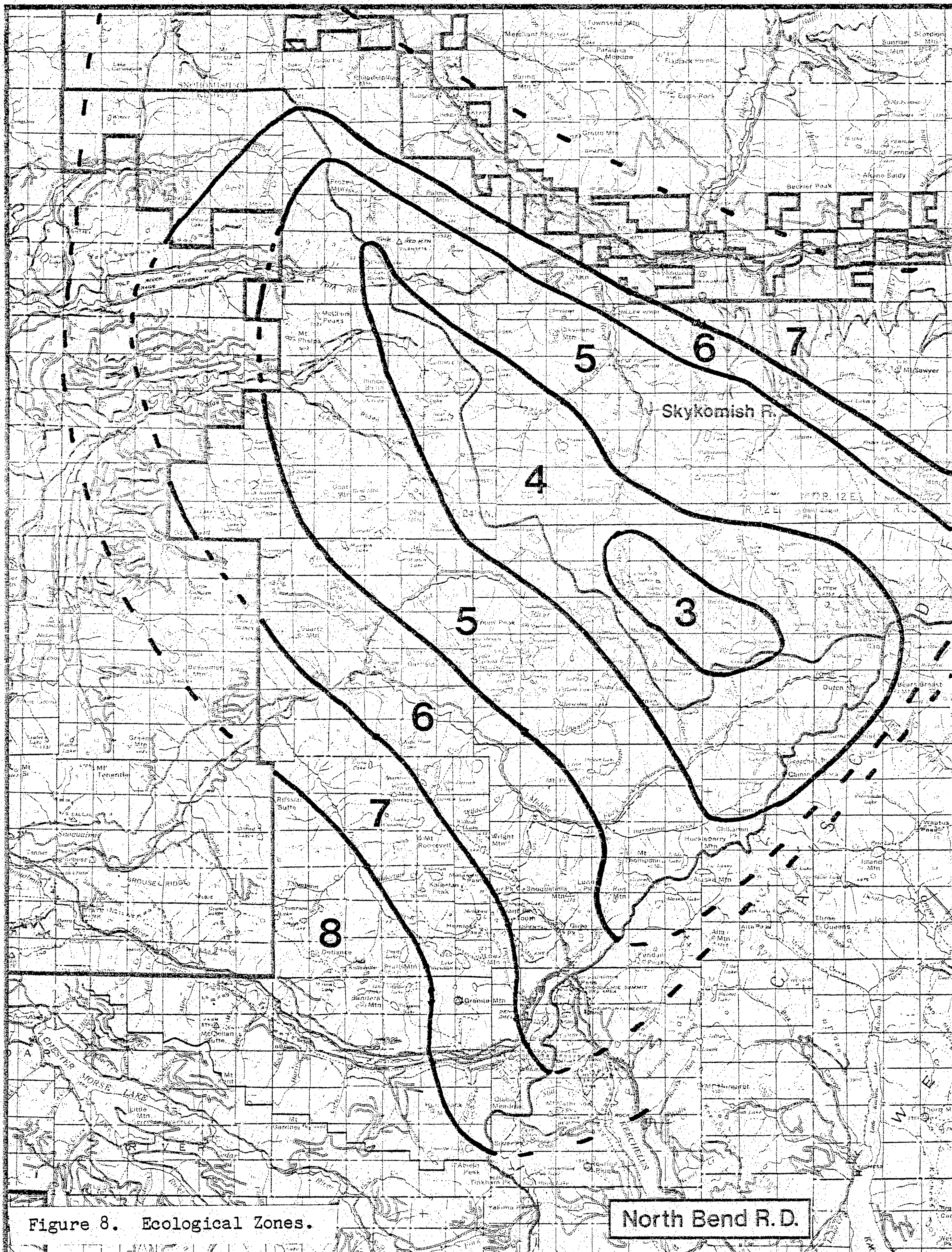

Figure 8. Ecological Zones.

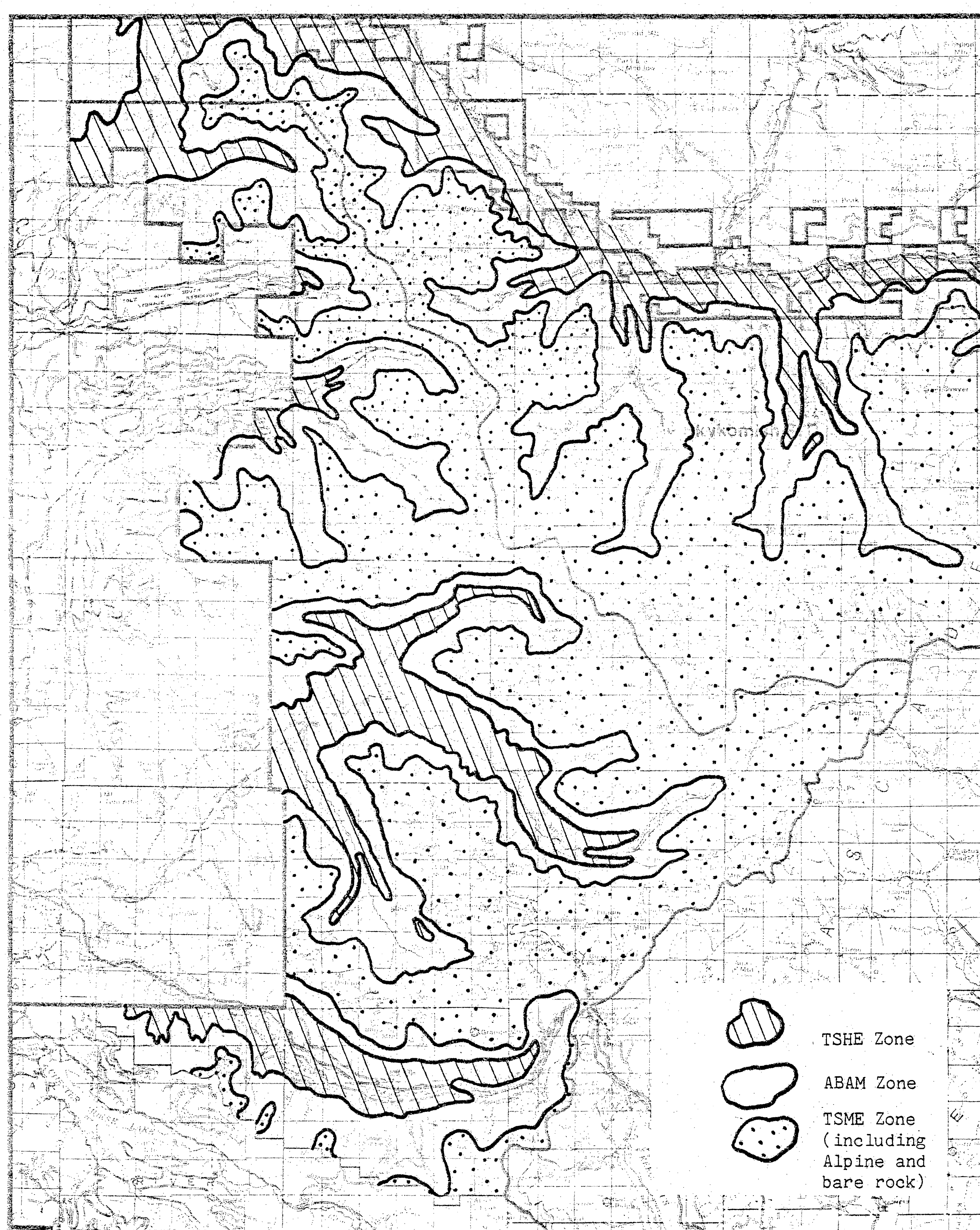

Figure 9. Map of Vegetation Zones, Snoqualmie and Skykomish Drainages.

Tsuga mertensiana (Mountain hemlock, Tsme) Series

The _Tsuga mertensiana_ series occupies an area of ground (i.e. the Tsme zone) equivalent to about 40% of the study area (Figure 9). It occurs above about 3300 feet (1000 m) (Figure 6) and below the bare rock and subalpine meadows. As used here it includes both the closed forest subzone and the portion of the Parkland subzone with trees. The meadow types, predominantly the heather-huckleberry and black sedge types (Henderson 1974), sometimes included in the mountain hemlock zone are briefly discussed on pages 68 and 80.

The Tsme zone is characterized by more than 100 inches (254 cm) of precipitation, cold maritime temperatures and considerable cloudiness throughout the year. Most of the precipitation comes as snow and results in a deep winter snowpack, usually more than 10 feet (3.3 m) deep which persists well into the spring. This late lying snowpack, while retarding the growth of trees and greatly affecting the understory species, is also a very significant source of ground and stream water through the summer. Toe slopes at low elevations may be more moist and therefore more productive if fed by ground water from the mountain hemlock zone.

Most (possibly all) avalanches originate in the Tsme zone or higher. Steep open slopes without trees are where most start. Sometimes these areas are recent burns which have not regenerated to trees. The long regeneration lag (20-150 years) here makes some of these avalanche areas a relatively permanent feature of the landscape. Several of the burns from about the turn of the century are still prime huckleberry (Vame) picking areas. The steeper parts of these areas are also good areas for avalanches to start. A possible use of local silvicultural expertise which is not commonly thought of might be to accelerate restocking of some of these areas to reduce avalanche hazard; for example along the Snoqualmie Pass Highway in the old Granite Mountain burns.

The temperature regime here is probably a more significant environmental factor than the moisture pattern, except perhaps for the physical forces of the heavy snowpack itself. Cold soils due to the lower ambient air temperature and the depth and lateness of the snowpack probably precludes many lower elevation species here. Summer soil temperatures at a depth of about 20cm (8") seldom get above 12° C (54° F). This upper zone of the soil is maintained at or near freezing temperatures by the insulating effects of the snowpack throughout the winter, and warm very little until the snowpack is gone. Then there is a rise in soil rooting zone temperatures until cool rains resume in the fall. This short period of time of soil warming is a significant ecological factor in the Tsme zone. In addition to the cold soil temperature in the rooting zone, the effect is compounded by the occasional high soil surface temperatures. This extreme difference in temperature within only a few centimeters at the soil surface is very harsh environment for plants to germinate and become established.

Soils are variable, but generally typical of high mountainous areas. They are mostly poorly developed, cold soils, developed from steep, shallow and unstable colluvium, remnants of alpine glacial till or residual material. Most of the stands sampled occurred on granite bedrock.

Due to the short growing season and cold temperatures, timber stand growth and tree re-establishment (succession) following disturbance, are generally quite slow. The mean tree height (based on silver fir or mountain hemlock) expected at age 100 years was calculated to be 65.9 ft. (20.1 m) with a range of indivi-

dual stands from 25 to 110 (8-34 m). This is based on tree age, however, and not total stand age. Since there is often a long establishment period following disturbance of 30 to 150 years in this zone, and often very suppressed height growth in the early years, this may represent a substantial overestimate of what might be achieved starting from the time of disturbance. Basal area for these same stands (200-700 years estimated ages) average 220 ft^2/ac (50.7 m^2/ha) with a range from 87-301 ft^2/ac 920-69 m^2/ha).

Six Tsme Associations are recognized based on sampling of 88 plots in this area. They are Tsme/Vaal, Tsme/Phem-Vade, Tsme/Vame, Tsme/Depauperate, Tsme/Rhal and Tsme/Clpy-Blsp. Of these Tsme/Vaal is by far the most common, occurring on about 55% of the mountain hemlock zone in this area. The next most common Association is the high elevation parkland type Tsme/Phem-Vade. Tsme/Clpy-Blsp and Tsme/Rhal are types of cold-wet places in the highest precipitation area. Together they represent about 11% of the Tsme zone.

Key to the Associations in the <u>Tsuga mertensiana</u> Series

1. Copperbush (Clpy) $\geq$ 20% cover, Deer fern (Blsp) usually $\geq$ 20% . . . . Tsme/Clpy/Blsp p. 25

1. Not as above . . . . (2)

    2. White rhododendron (Rhal) $\geq$ 7% cover. . . . . Tsme/Rhal p. 26

    2. Not as above . . . . (3)

        3. Alaska huckleberry (Vaal) $\geq$ 15% cover. . . . . Tsme/Vaal p. 27

        3. Not as above . . . . (4)

            4. Blue-leaf huckleberry (Vade) and/or Red heather (Phem) $\geq$ 25% cover . . . . Tsme/Phem-Vade p. 29

            4. Not as above (5)

                5. Thinleaf huckleberry (Vame) $\geq$ 10% cover. . . . . Tsme/Vame p. 31

                5. Not as above (6)

                    6. Total understory $\leq$ 20% cover . . . . Tsme/Depauperate p. 33

                    6. Not as above - Does not key. Community may be in seral or disturbed condition or may represent an unrecognized Association for this area.

Table II. Selected Environmental and Physical Features for Associations in the *Tsuga mertensiana* Series

	Tsme/ Clpy/Blsp n=3	Tsme/ Rhal n=4	Tsme/ Vaal n=43	Tsme/ Phem-Vade n=16	Tsme/ Vame n=12	Tsme/ Dep. n=9
Elev. (ft.)	3780±190	4510±490	3500±440	4726±500	4342±450	4230±610
Aspect	N	NE	W	W	E, S, W	S, W
Slope	62±11	31±12	38±23	50±38	72±43	65±16
Top ht. (ft)	112±6	79±24	127±22	91±28	103±26	124±18
H_{100}	58	36	77	39	68	76
BA old-growth (ft^2/ac)	207	194	231±87	139±80	213±75	233±97
BA_{100} (ft^2/ac)	98	95	150	44	9*	157
Vol_{100} (ft^3/ac)	1900**	1400	3400	350	200	4000
Ave. age (yrs)	319+	413+	400+	277	393	351
Culm. MAI (yrs)	300	300	220	280	320	150
MAI_{100} ft^3/ac/yr	19	14	34	4	2	40

* Based on prompt regeneration these values for Tsme/Vame are: BA_{100} = 150 ft^2/ac; Vol_{100} - 3460 ft^3/ac; culmination of MAI = 80 years; MAI at 100 years = 29 ft^3/ac/year.

**Volume estimates given here and elsewhere are intended to be used as <u>relative</u> measures for comparison, not as absolutes.

TABLE III. Average Coverage Values for Associations in the <u>Tsuga mertensiana</u> Series. "." indicates average cover less than 1 percent. Values given are absolute mean coverage values for the type i.e. zero's are included in calculating the means.

<u>TREES</u>	<u>Tsme/Clpy/Blsp</u> n=3	<u>Tsme/Rhal</u> n=4	<u>Tsme/Vaal</u> n=35	<u>Tsme/Phem-Vade</u> n=7	<u>Tsme/Vame</u> n=7	<u>Tsme/Dep.</u> n=5
ABAM	3*	16	32	6	41	36
ABLA2				.		1
ABPR					.	3
CHNO	5	.	9	1	1	10
THPL	.		.			
TSHE			8		4	6
TSME	45	43	38	41	36	29
SHRUBS <u>AND HERBS</u>						
ALSI			1			
ARLA	.		.	1		
ATFI			1		.	
BLSP	35	2	1	.	.	.
CAME		8		4	.	
CANI2	.		1			
CLPY	40	3	.	.		1
CLUN	1		2		2	.
COCA			1			
COME	.		.			
DEAT	.	.		1	.	
GAOV	1		.		1	.
GOOB				.	.	.
GYDR			1		.	
LUPA					.	.
LUPE		.		.	.	.
MEFE	7	2	11	1	13	4
OPHO			1			
PHEM	1	16	3	19	2	.
PTAQ			.		.	
PYSE			.	.	.	.
RHAL		14	.	1	.	
RIHO						1
RULA	2	.	1	.	2	.
RUPE	4	7	6	.	1	1
RUSP			1		.	
SASI			.		.	
SMST			1			
SOSI	3	2	1	.	1	
STRO	.	.	1		.	
TITR			.		.	
TIUN			1		.	
VAAL	10	13	59	.	1	1
VADE		14	.	21	3	1
VAME	4	23	9	7	49	1
VAOV	.	1	5	.	12	1
VASI				.	1	
VEVI	.	.	.		.	
XETE					5	

Tsuga mertensiana/Cladothamnus pyroliflorus/Blechnum spicant (Mountain hemlock/Copperbush/Deer fern, Tsme/Clpy/Blsp) Association

The _Tsuga mertensiana/Cladothamnus pyroliflorus/Blechnum spicant_ Association occurs only infrequently in the high precipitation area centered around Dorothy Lake. It is not known elsewhere in this country, but may possibly be discovered in other cool, high precipitation areas yet to be sampled. It is reported for British Columbia by Brooke et al. (1970). It is found on moist microsites which may be boggy but not flat or have subsurface water flow. This represents one of the moistest high elevation types of this area. Three plots were sampled. It is estimated that there is about 4 square miles (3%) of this type in the study area. These plots varied from 3660 to 4000 feet (116-1219 m) elevation on moderate to steep (62%) northwesterly slopes. Dominant top height averaged 112 feet (34 m) and projected tree heights at 100 years averaged 58.0 feet (17.7 m) Figure II). Basal area of old-growth stands averaged 207 ft^2/ac (48 m^2/ha). This low stocking and very low site index is typical for the mountain hemlock zone. Productivity estimates show a projected culmination of mean annual increment at about 300 years and a MAI of about 24 ft^3/ac/year. A yield capability at 100 years is estimated to be 19 ft^3/ac/year. Wildlife and other values of this type are unknown. Due to the rarity of this type and the extreme conditions under which it develops, it warrants further study to determine whether rare or sensitive plants or animals occur here.

No disturbance factors (fire, wind, etc.) are recognized for this type. This type appears so fire resistent that the communitites sampled might be very much older than the age of constituent trees.

Sampled communities were clearly dominated by mountain hemlock, with silver fir and yellowcedar also present. Understory species included _Cladothamnus_ and _Blechnum_ plus _Vaccinium alaskaense_, _Menziesia ferruginea_, _Rubus pedatus_ and _Gaultheria ovatifolia_ (Table III).

This type is not previously recognized in this country. It appears to have been recognized by Brooke et al. (1970) in British Columbia.

Tsuga mertensiana/Rhododendron albiflorum (Mountain hemlock/White rhododendron, Tsme/Rhal) Association

The Tsuga mertensiana/Rhododendron albiflorum Association occurs sporadically at high elevations, (4100-5200 feet, 1250-1585 m) and northeasterly aspects in the study area, mostly in the high precipitation area (Figure 2) around Dorothy Lake. It is also now on similarly moist sites south of this area and will probably be encountered to the north. Four plots were sampled from this area. This makes a total of 13 plots sampled in planning area I. It is known from the Findley Lake area of the Cedar River drainage (Del Moral 1973) from near Bear head lookout in the Carbon River drainage (Henderson and Peter 1981c), from Mount Rainier National Park (Franklin et al. 1979) from the Shelton District near Mount Tebo (Henderson and Peter 1981a) and from one location on the Quinault District from near Colonel Bob (Henderson and Peter 1981b). Although not recognized, this type is represented in the data of Brooke et al. (1970).

Dominant tree heights in old growth stands averaged 79 feet (24 m) at 413 years and only 36 feet (11 m) at 100 years (Figure 10). This compares to 46 feet (14 m) for the same type on the White River District and 26 feet (8 m) on the Shelton District. Basal area of old growth stands was quite variable owing to the clumping nature of these stands, but averaged 19 ft^2/ac (45 m^2/ha). Productivity potential is low. Maximum old growth volumes estimated from sampled stands are about 5100 ft^3/ac with a culmination of MAI at about 300 years and 17 ft^3/ac/yr. MAI at 100 years is estimated to be 14 ft^3/ac/yr.

Wildlife and other values are not well known. It may provide some hiding and thermal cover for summering elk. It is also important cover on major high elevation watersheds.

Disturbance factors in this type are not well known. Fires from warmer, lower elevation sites can sometimes slop over into this type but fire is not easily carried and often goes out. Snow movement and avalanches can be a factor if originating on higher sites. Communities representing the Tsme/Rhal Association occur high enough in the mountains to have been affected by the at least the last lobe of the little ice age which reached its maximum about 1705. These communities have been developing in response to a subtle warming trend and lower snowpack accumulations for the past couple hundred years. Ages of trees suggest that forest cover was established before this ice age but very few trees were established during and that many trees have become established since. These cold, snowy climates are still a driving force behind the development of this type.

Sampled communities were dominated by mountain hemlock with lesser amounts of silver fir. White rhododendron (Rhal) is at least a codominant, although one or more of the huckleberries (Vaal, Vame, Vaov) can be a major species in the community. Red heather (Phem) and even white heather (Came) are commonly encountered. Herbs are sparse, with Rubus pedatus, Blechnum spicant and Mitella breweri usually present.

Tsuga mertensiana/Vaccinium alaskaense (Mountain hemlock/Alaska huckleberry, Tsme/Vaal) Association

The *Tsuga mertensiana/Vaccinium alaskaense* Association is well represented in the study area, where 35 plots were sampled. It is by far the dominant *Tsuga* type in this area, with several phases suggested. It is also represented in most other areas studied. It ranges mostly from 3000 to 4500 feet (914 to 1372 m) with an average elevation of 3500 feet (1067 m). Aspects are variable, but most commonly westerly.

Fire and Wind Disturbance

Little is known of the fire history of the Tsme/Vaal type in this area. It is presumed that, because of the lack of evidence to the contrary that this type seldom burns, and in fact provides a suitable fire break when encountered. Wind disturbance is minor. Some areas are influenced by avalanches.

Species Composition and Succession

The tree layers of this association are dominated by mountain hemlock and silver fir, plus lessor amounts, on the average of yellowcedar in wetter places and western hemlock at lower elevations Table III. The proportion of silver fir and mountain hemlock changes from more siver fir and a minimum amount of mountain hemlock at lower elevations or drier aspects to a greater dominance by mountain hemlock at higher elevations and colder sites but more typically they codominate the oldest stands and the projected climax community contains both as codominants.

Understory layers are clearly dominated by Alaska huckleberry (Vaal) or Ovalleaf huckleberry (Vaov). However, other shrubs including thinleaved (Vame), fool's huckleberry (Mefe), Devil's club (Opho) or salmonberry (Rusp) may codominate on certain sites. Common herbs include *Clintonia uniflora*, *Rubus pedatus*, *Rubus lasiococcus* *Streptopus roseus*, and *Blechnum spicant*.

Timber Productivity

Timber productivity potential in this extensive type is low (Table II). Top heights of dominant trees in old growth communities averaged 127 feet (38.7 m) and basal area averaged 231 ft^2/ac (53 m^2/ha). Based on top height curves for this type (Figure 10) dominant trees are expected to be 77 feet tall at 100 years of tree growth (much lower after 100 years following disturbance because of the establishment lag for this type). Volume peaks at about 12,000 ft^3/ac at about 500 years. About 3400 ft^3/ac can be expected when the dominant trees are 100 years old. This yields a MAI at 100 years of 34 $ft^3/ac/yr$. Culmination was estimated to occur at about 220 years when a maximum 36 $ft^3/ac/yr$ is attained.

Wildlife Relations

Little is known about the relationship of this type to wildlife. However, it probably provides some part of the summer range for deer and elk (where they are present). Mountain goats are occasionally spotted in this type, but are probably only passing through.

Distribution and Relation to other Types

This type is strongly related to the Abam/Vaal type at lower elevations which is recognized by the absence of mountain hemlock and greater abundance of western hemlock. Relative to the other associations in the Tsme series, this type is considered modal for this area. Tsme/Vame and Tsme/Depauperate are drier, Tsme/Clpy/Blsp is wetter and Tsme/Rhal and Tsme/Phem/Vade are colder.

This type is not recognized in Oregon, however the plot data of Dyrness et al. (1974) suggests that fragments of it might occur as far south as the H.J. Andrews Experimental Forest. It was not recognized by Franklin et al. (1979). Communities herein recognized as belonging to the Tsme/Vaal association are absorbed into his Chno/Vaov and Abam/Vaal types. This type is recognized as the Abam/Vaov and the Tsme-Abam/Vaal-Mefe community types by Del Moral et al. (1976) for the Middle Fork of the Snoqualmie River. A dry phase, called the Abam-Tsme/Vaal/Xete community type, was recognized in the Hoh drainage in the Olympics (Henderson et al. 1979). The Tsme/Vaal Association is previously recognized on the White River and North Bend Districts Henderson and Peter (1981c, d) and on the Shelton and Quinault Districts, Olympic N.F. Henderson and Peter (1981a, b). It was not recognized on the Soleduck District Henderson and Peter (1982a). It is recognized in British Columbia by Brooke et al. (1970).

Phases and Variations

This is an extensive type with some possibilities for further subdivision. A possible phase recognized by the codominance of Vame is transitional to the Tsme/Vame type but is more similar in most characteristics to the Tsme/Vaal. Mefe and Vaov can codominate on colder sites within this type. These too may form the basis for reorganizing another phase. In other areas the presence of Xete may form the basis for recognition of still another (dry) phase. There are some subtle differences between these "phases" that related to minor environmental differences within this type. There were no significant successional or productivity and no compelling statistical differences, therefore there was more incentive to aggregate them into one Association than to split it apart.

Tsuga mertensiana/*Phyllodoce empetriformis*-*Vaccinium deliciosum* (Mountain hemlock/Red heather-blueleaf huckleberry, Tsme/Phem-Vade) Association

The *Tsuga mertensiana*/*Phyllodoce empetriformis*-*Vaccinium deliciosum* Association is the common Parkland type in the study area. It is considered a "woodland" type according to the new national "RET" classification since in its mature form it averages less than 40% tree cover. Given current climatic conditions it is considered a stable type dominated by widely spaced trees in groups of trees often with little vegetation under the tree clumps and mostly a mosaic of the subalpine heather-huckleberry type between. It occurs mostly above 4500 feet (1372 m) but may be found down to 4200 feet (1280 m) in cold pockets or exposed ridges. Aspects are generally southwesterly. Slopes vary from gentle to very steep. Sixteen plots were sampled which represent this type, several other heather huckleberry meadow plots may also have been included. It is estimated that there is about 21 square miles of this type in this area, that is about 16% of the mountain hemlock zone for this area.

Fire and Wind and Other Long Term Environmental Disturbances

The very sparse evidence of fire in this type indicates only small spot fires started by lightning strikes. It is virtually impossible for fire to be carried very far in this type. We know of no significant windthrow damage in this type. Wind action and the abrasion of wind-carried ice appears to at least partially limit this type as it grades into Krummholz in some areas. Wind desiccation in summer may be a significant factor in limiting the growth of trees by maintaining a high level of water stress and retarding the maturation of plant tissues.

The greatest disturbance factor in this type over the last 1000 years or so has been the combined effects of climatic shifts associated with episodes of the "Little Ice Age". Few trees are found which can be dated to the periods of ice advance 1645-1715 a.d. and 1416 to 1534 a.d. Most tree clumps in this type contain trees under 200 years old, a few contain older veterans, 350-450 years and fewer yet contain trees which predate the 1416-1534 ice advance. These trees are mostly about 600 years or older than 700 years.

The dynamics of this type are profoundly affected by the climatic shifts associated with these ice advances. Succession in this type is so slow that, even though there is some evidence that total tree cover is increasing toward canopy closure, there will likely be another little ice age before a significant change occurs.

Species Composition and Succession

The tree clumps which constitute the "overstory" of this type are dominated by mountain hemlock with only minor amounts of silver fir or yellowcedar.

The meadow-like mosaic between tree clumps is of the typical heather-huckleberry type with red heather (Phem), blueleaf huckleberry (Vade) and White heather (Came) predominating. Thinleaf huckleberry (Vame) is sometimes found associated with the tree clumps. Other species sometimes encountered are Cani2, Deat, Lupe, Mefe and Sosi (Table III).

Succession on this type is so long term and complicated by climatic fluctuations that it is very difficult to figure out and describe. Primary succession begins on deglaciated rubble or secondary succession begins with the effects of a warming trend on a heather-huckleberry meadow. Primary successional species such as Phem, Vade, Lupe, Lula or Luzula spp. may dominate early stages.

Timber Productivity

Timber productivity potential is extremely low. Trees which were estimated to be 100 years old were 39 feet (12 m) tall. Basal area for sampled plots averaged 139 ft^2/ac (32 m^2/ha). This is an overestimate because no plots which fell wholly between tree clumps were included. Based on this overestimate of stocking, culmination was estimated at 16 ft^3/ac/yr at 280 years. Productivity at 100 years was estimated to be 3.5 ft^3/ac/yr (Table II).

Wildlife Relations

Little is known about the relationships of this type to wildlife. It probably provides some part of the summer range of black-tail deer and is a major part of the habitat of mountain goats, although their direct use is unknown.

Distribution and Relation to Other Types

This type is strongly related to the non-forest heather-huckleberry type (Henderson 1974). It is also slightly related to the Tsme/Vame type which occurs at lower elevations and has a more typical closed forest canopy and to the Tsme/Rhal type which occurs at high elevations but on colder, more northerly aspects.

This type occurs at least as far south as Mount Rainier, although it was not recognised by Henderson (1974) or Franklin et al. (1979). We did not recognize it in earlier surveys of other areas Henderson and Peter (1981a, b, c, d). It was recognized in the Olympics by Henderson et al. 1979 and in the upper Middle Fork of the Snoqualmie River by Del Moral et al. (1976). It is recognized by Brooke et al. 1970 for British Columbia.

Tsuga mertensiana/Vaccinium membranaceum (Mountain hemlock/thinleaf huckleberry, Tsme/Vame) Association

The Tsuga mertensiana/Vaccinium membranaceum Association occurs on dry-warm habitats in the Tsme zone throughout the area but mostly in the lower precipitation areas around the fringe. Sampled locations varied from 3800 ft (1158 m) where it closely resembles the Abam/Vame type to 5500 ft (1676 m) where it begins to grade into Krummholz communities. It occurs mostly on south to westerly aspects on moderate to steep or even gentle (but well drained) slopes. It is estimated that there is about 18 square miles of this type, which is about 14% of the mountain hemlock zone for this area.

Fire and Wind and Other Long-term Environmental Disturbances

Fires of any extent are uncommon in the mountain hemlock zone. When they occur they are most likely in the Tsme/Vame type or other closely related types. The fire about 80 years ago on Tonga Ridge occurred mainly in this type. Also, the Granite Mountain burns appear to have burned into this type. Wind disturbance is minor.

Long-term climatic fluctuations are not as important in this type as in the Tsme/Phem-Vade at higher elevations. However, there is some evidence that portions of this type that occur today were, within recent geologic time, more similar to the Tsme/Phem-Vade type. As climates have warmed and vegetation zones have advanced slightly higher in elevation, this replacement has taken place at what would have been the ecotone between these two types.

Species Composition and Succession

Mountain hemlock and silver fir codominate the old-growth communities in about equal amounts (Table III). Western hemlock (at other elevations) and yellowcedar were also encountered. Noble fir and even Douglas-fir are sometimes found in the driest portion of this type, although they were not sampled in this area.

The ground vegetation layers are dominated by thinleaf huckleberry (Vame) white fool's huckleberry (Mefe) may codominate on some sites. Blueleaf huckleberry (Vade) may be seral and will persist into young old-growth stands at higher elevations. Other huckleberries are uncommon. Mountain ash (Sosi) is encountered with high frequency but low average cover. Common herbs include Rubus lasiococcus, Clintonia uniflora, Arnica latifolia and Rubus pedatus. Beargrass (Xete) is encountered on the dry portion of this type where it identifies the beargrass phase (Tsme/Vame-Xete) (Table III).

Succession on this type following fire (or clearcutting) is very slow. Brush fields of huckleberries although very popular with berry pickers, may persist for 50-150 years before trees reclaim the site. Under the most favorable conditions with some residual seedlings from the previous stand still appear to take about 20 years to approach normal stocking. Most of the railroad fires from around the turn of the century are still huckleberry fields.

Timber Productivity

Timber productivity potential is low. Mountain hemlock trees average 68 feet (21 m) at 100 years. Old growth stands, 300 to 700 years old, averaged 213 ft^2/ac. (48 m^2/ha) of basal area. However, at 100 years, on the average, there was still only about 9 ft^2/ac (2 m^2/ha). There are also many other communities not included in this average, which had no basal area at all. Old growth volume appears to peak at about 7500 ft^3/ac at about 400 years. Culmination of MAI was calculated to occur at 320 years with 22 ft^3/ac/year. Volume after the first 100 years of natural stand growth was calculated to be less than 200 ft^3/ac. This gives a MAI for the first 100 years of about 2 ft^3/ac/year. If prompt regeneration could be obtained in this type, these values would be much higher (Table II).

Wildlife Relations

Deer and bear use this type in the summer, especially in young and early seral stages. The fruits and foliage provided by thinleaf huckleberry may also be important in the summer diet of many other wildlife species. Goat hair is sometimes collected in this type but it is not known how much goats use it.

Distribution and Relation to other Types

The Tsme/Vame Association is found from the central Oregon Cascades where it is included by Dyrness et al. (1974) and by Hemstrom and Emmingham (1981a) in th Abam/Vame/Xete type. It is recognized on the Mt. Hood and Gifford-Pinchot National Forests by Hemstrom and Emmingham (1981b, c) as the Abam-Tsme/Vame Association. It was not recognized by Franklin et al. (1979) for Mt. Rainier National Park. However, it is represented in their samples and they have split up this type into segments of the Abam/Rhal, Abam/Mefe and Abam/Rula types. It was recognized by Henderson and Peter (1981 c) for the White River District but not for the Green and Cedar River drainages although it is to be expected there (Henderson and Peter 1981d). Del Moral (1973) may have sampled it in the Findley Lake basin but he did not recognize it there. It was recognized as the Abam/Vame-Vaov community type by Del Moral and Long (1977) for the Cedar River drainage and as the Tsme-Abam/Vame-Mefe community type by Del Moral et al. (1976) in the upper Middle Fork of the Snoqualmie drainage.

In the Olympics it was recognized as the Abam-Tsme/Vame community type by Henderson et al. (1979) and as the Tsme/Vame Association by Henderson and Peter (1981a, b). Brooke et al. (1970) recognized the Vaccinio-Tsugetum mertensianae Association in British Columbia.

It also appears to have close relatives in the northern Rocky Mountains. It is similar to the Tsme/Mefe and Tsme/Xete habitat types of Daubenmire and Daubenmire (1968) in northern Idaho and even to the Abla/Vagl type of Pfister et al. (1977) for Montana.

Tsuga _mertensiana_/Depauperate (Mountain hemlock/Depauperate, Tsme/Dep.) Association

The _Tsuga_ _mertensiana_ Association occurs on steep mid to upper slope positions, on well drained but cool sites. Although it may occur from 4000-5000 feet (1220-1525 m) it usually occurs at the dry edge of the range of the mountain hemlock zone. All stands sampled were in the Middle fork of the Snoqualmie River drainage.

Volume estimates (Table II) indicate this is one of the more productive types within the mountain hemlock zone. With a yield capability perhaps as much as 40 ft^3/ac/year. This is double the required capability to the biologically commercial forest land but only about half what is usually considered economically commercial.

Mountain hemlock and Silver fir codominate the tree layers (Table III). The ground vegetation layers are sparse (Depauperate), typically with only about 5 percent or less total understory cover. In this area _Menziesia_ _ferruginea_, _Cladothamnus_ _pyroliflorus_, _Vaccinium_ _alaskaense_, _Vaccinium_ _membranaceum_ and _Rubus_ _pedatus_ Table III are the most common understory species.

This type is not recognized elsewhere.

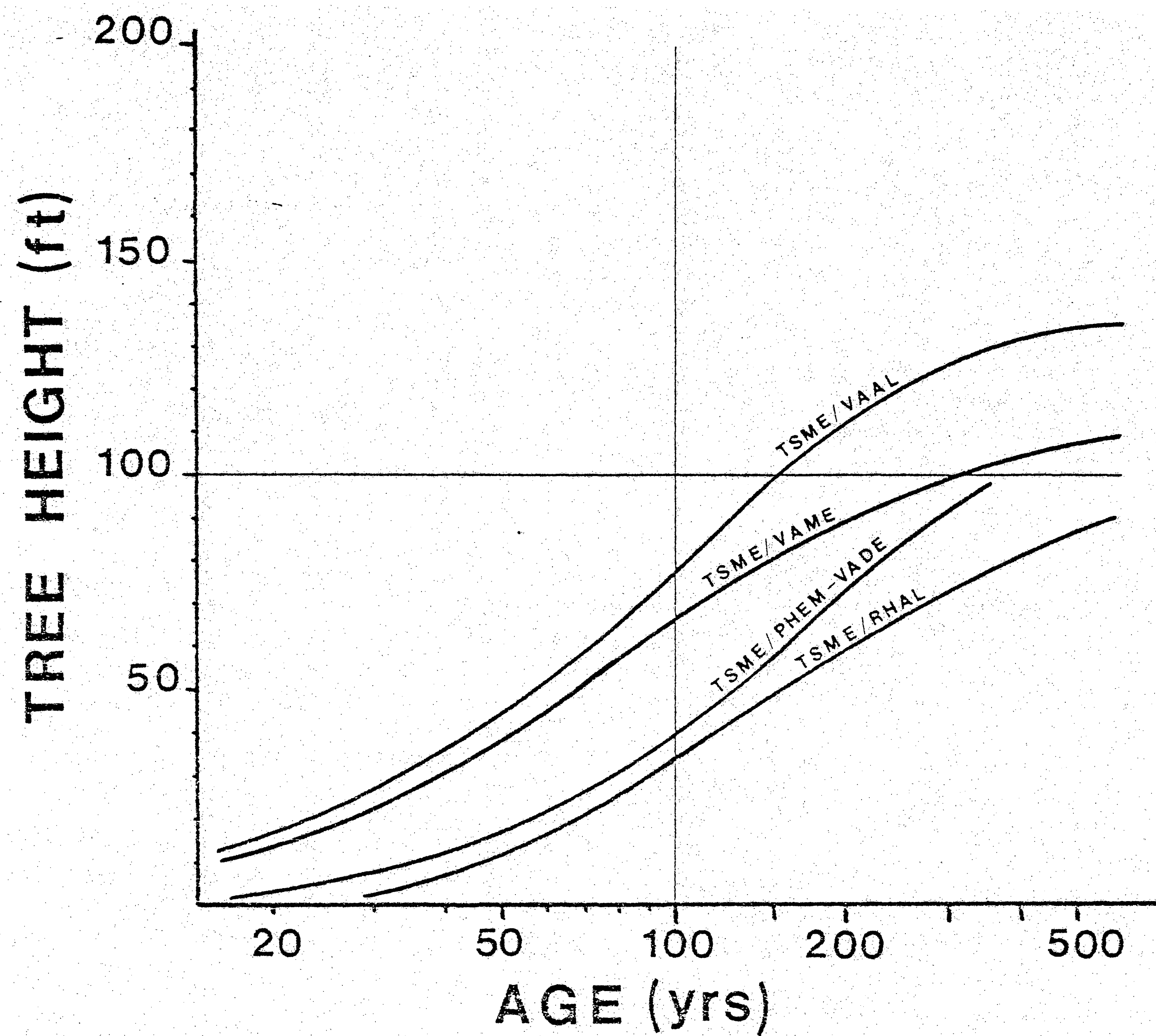

Figure 10. Height Growth Curves for the Common Tsuga mertensiana types.

Abies amabilis (Silver fir, Abam) Series

The Abies amabilis (Abam or silver fir) series represents about 63,000 acres (25,500 ha) or about 31% of the area. A total of 76 plots have been taken in the Abam zone, of which 56 represent old-growth communities.

Four Associations are recognized from the data, the Abam/Vame, the Abam/Vaal, the Abam/Opho, and the Abam/Dep. By far the most extensive of these is the Abam/Vaal type, for which several phases can be recognized.

The Abam series occurs on the cooler, mid-elevation slopes and moist stream bottoms. On the slope it occurs from about 1500 feet (350 m) on north aspects to 2300 feet (700 m) on south aspects; up to 3000 feet (900 m) on north aspects to 3500 feet (1067 m) on south aspects. In stream bottoms it occurs down to about 1200 feet (365 m). The elevational relationships in this area are more complex than others, as represented in Figure 6 and Figure 7.

The Abam zone is characterized by cooler moist soils, persistent winter snowpack, a general lack of summer plant water stress and a short cool growing season. Mean annual temperature in this zone is between 5-7°C (41-45°F) while the warmer Tshe zone averages 10.1°C (50.2°F) and the colder, snowier Tsme zone ranges from 3-5°C (37-41°F). Precipitation in the Abam zone is over 100 inches (254 cm) annually with much of it coming as snow and persisting on the ground until April at the low elevations and June at high elevations. These climatic factors result in a much longer fire return period and much lower fire risks than the Tshe zone.

Wildlife values in the Abam zone are lower than the Tshe zone which provides must of deer and elk winter range and the Tsme zone which provides mainly summer range. The Abam zone can provide much of the sring runoff and is therefore important hydrologically because of the delayed discharge. the Abam zone in generl provides considerable dispersed recreation activity and is important as an esthetic backdrop to many scenic vistas.

Key to the Associations in the *Abies amabilis* Series

1. Alaska huckleberry (Vaal) $\geq$ 20% cover . . . . .Abam/Vaal p. 39

1. Not as above. . . . . (2)

2. Devil's club (Opho) $\geq$ 10% cover . . . . .Abam/Opho p. 45

2. Not as above. . . . . (3)

3. Thinleaf huckleberry (Vame) $\geq$ 10% cover . . . .Abam/Vame p. 46

3. Not as above. . . . . (4)

4. Total ground vegetation cover $\leq$ 10% . . . .Abam/Dep. p. 48

4. Does not key, reduce coverage values in the key by half and return to lead 1; or plot may not key because it is too disturbed or seral or is an unrecognized Association for this area.

Table IV. Selected Environmental and Physical Features for Associations in the *Abies amabilis* Series

	Abam/Vaal n=38	Abam/Opho n=2	Abam/Vame n=7	Abam/Dep. n=8
Elevation (ft.)	2601±760 *	2045	4006±500	2742±1150
Aspect	All	NW,S	S	S,W
Slope (%)	36±18	40	50±13	39±25
Site index (Ft.) (McArdle&Meyer 1930)	119	135	105	117
Top height (old-growth)	160	171	151±23	155±25
Height at 100 years	122	125	95	102
Basal area years (ft^2/ac)(old-growth)	240	207	255	272
Basal area (ft^2/ac) at 100 years	225	175	195	260
Vol. (ft^3/ac) (old-growth)	13,000**	12,000	11,000	14,000
Volume at 100 years	8,200**	7,300	6,100	8,800

* Values ± standard deviation.

** Volume estimates given here and elsewhere in this report are intended to be used as relative measures for comparison, not as absolutes.

Table V. Average Coverage Values for Associations in the _Abies amabilis_ Series. "." indicates a coverage less than one percent. Zero values included in averages.

TREES	Abam/Vaal n=38	Abam/Opho n=2	Abam/Vame n=3	Abam/Dep. n=5
ABAM*	47	25	48	61
CHNO	1		12	
PSME	1	2	13	1
THPL	5	13	1	6
TSHE	45	43	49	49
TSME	1		2	
SHRUBS-HERBS				
ACCI	3	32		1
ACTR	1	1		.
ALSI	.		3	
ATFI	1	5	1	.
BENE	1			
BLSP	6	5	.	2
CLUN	2	2	5	1
COCA	3	1		.
LIBO2	1	2		
MADI	3	1		
MEFE	2	1	2	1
OPHO	1	40		1
POMU	1	3		.
PTAQ	.		5	
RULA	.		1	
RUPE	5	1	1	.
RUSP	1	3		
SMST	.		.	
STRO	1			.
TITR	1	1	1	1
TIUN	1	3	.	.
VAAL	49	8	8	3
VAME	.		37	.
VAOV	2	1		.
VAPA	2	3	2	1

* See Table XII, Page A-3 for full scientific and common names of these species.

Abies amabilis/*Vaccinium alaskaense* (Silver fir/Alaska huckleberry, Abam/Vaal) Association

The *Abies amabilis*/*Vaccinium alaskaense* Association is common in this area where it is represented by 38 plots. It is found generally above 2000 feet, except in stream bottoms where it may be lower. Average slope was 36 percent measured for 38 plots in this type; however, slopes over 60 percent are not uncommon. Aspects are definitely southerly in contrast with other areas. The Tsme/Vaal type replaces this type on northerly aspects. This Association occurs on numerous different soil types (Snyder and Wade 1972). Average elevation (Table IV) was 2601 feet with a range from 1200 feet in the bottom of the Miller River to 3960 feet on a southwesterly upper slope position in the Hanson Creek drainage. Most elevations, however, were between 2200 and 3300 feet. Precipitation is generally over 100 inches, coming mainly as snow or cold rain during the winter. A snowpack accumulates typically from 1-3 feet on the warmer sites to 5 or 10 feet at higher elevations or cooler sites. A persistant winter snowpack is a major characteristic of this type, which persists usually until May or early June.

Fire and Wind Disturbance

Fires are very rare in this type. Many hundreds of years elapse between natural wildfires. The fire return period calculated for the Shelton District, Olympic National Forest, was 750 years. Too little data are available for the Snoqualmie and Skykomish drainages yet to make this calculation; however, it is expected to be between 500 and 1500 years. This is why there are so few stands in the 50-200 year age class. Wind is not a major long-term perturbation.

Species Composition and Succession

Western hemlock and silver fir codominate the canopies of old-growth stands in this type (Figure 11) averaging 47 percent each. This is typical of this type throughout its range. Neither hemlock nor fir appear to have a competitive advantage when you look at the total cover for the species in the community. Thus, they are considered co-climax species. Basal area of these two dominant species shows a somewhat different pattern, with silver fir declining with increasing age, while hemlock shows some tendency to increase. The increase in silver fir cover and decrease in basal areas shows a shift toward smaller size classes in older stands. Within this relatively broad type, hemlock predominates more in drier and lower elevation stands, while silver fir has the advantage in moister and higher elevation stands. Douglas-fir may occur in some drier sites in this type.

TABLE VI. Community Development Table for the _Abies amabilis/Vaccinium alaskaense_ Association Snoqualmie and Skykomish River drainages

Community attribute	Successional Stage-Age Class						
Average Ave. (Years)	10	43	175	252	361	441	715
Number of Plots	4	4	6	11	17	10	6
Top Height (Ft.)	14	72	165	160	151	163	160
Tree Basal Area (Ft^2/ac)	11	240	221	155	241	235	248
Canopy Cover, Overstory	32	87	91	79	80	76	83
Canopy Cover, Ground Veg.	94	51	70	71	73	78	73
Average Diameter of Dominants (Inches)	2	9	26	27	29	33	29
ABAM (Per Cent Cover)	11	56	37	50	51	41	46
PSME	5	4			1	2	3
THPL		3		2	4	7	10
TSHE	16	32	72	38	43	54	43
ACCI	3	6		5	1	3	
ATFI	2	1	2	1	1	2	.3
BLSP	6	1	8	8	4	5	6
CLUN	.3	2	1	2	4	2	1
COCA	.5	4	.2	3	4	2	2
EPAN	39	.5					
MADI	2		1	2	3	2	5
MEFE	.5	1	1	2	3	1	2
OPHO	1	1	3	1	1	3	.5
RUPE	2	1	6	2	3	5	4
RUSP	24	5	4	3	2	9	2
RUUR	4		.2		.1		
TITR & TIUN	1	3	4	3	1	2	.4
VAAL	28	11	36	42	52	52	41
VAOV	4			5	2	.5	5
VAPA	8	1	2	2	1	2	4

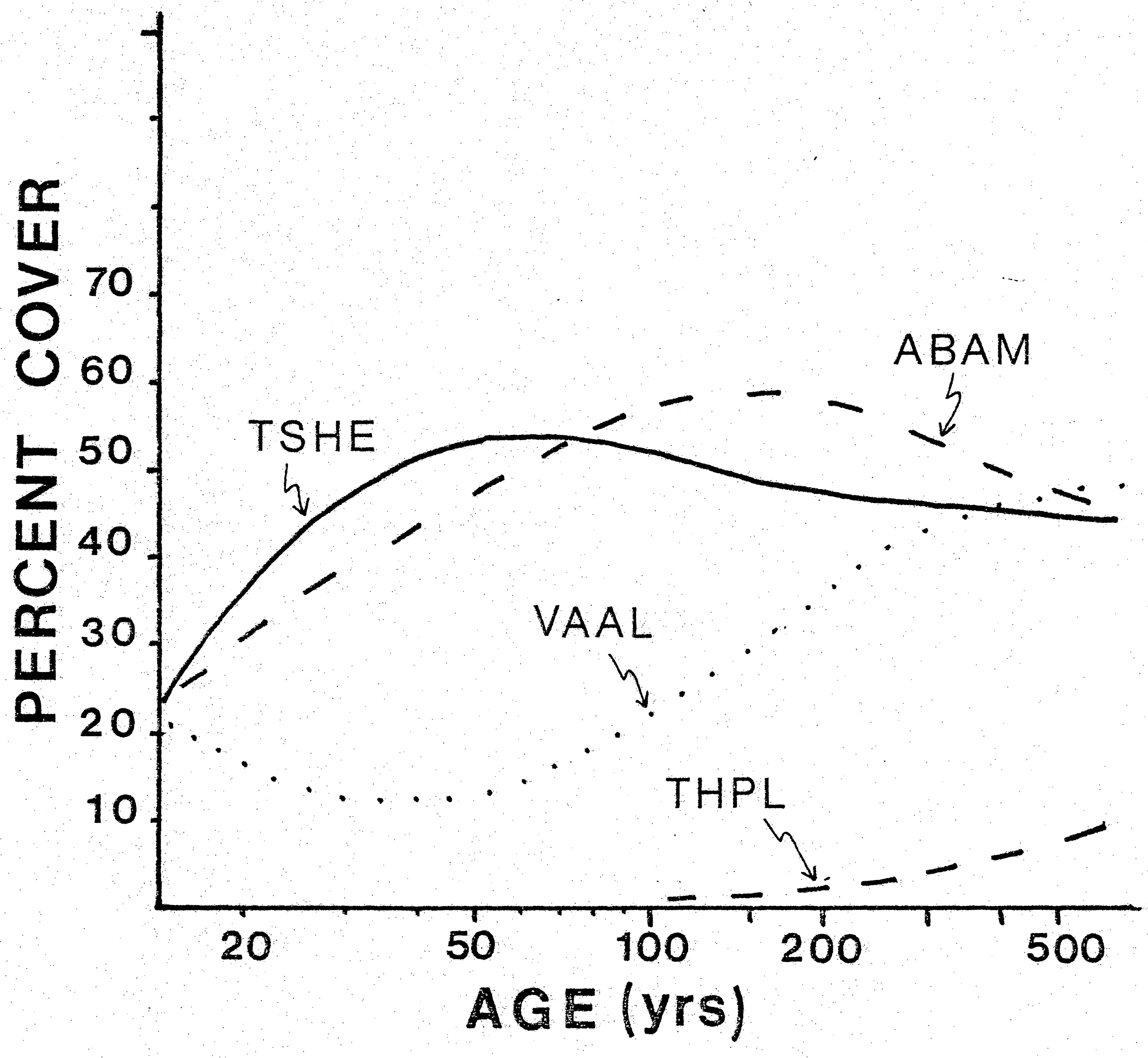

Figure 11. Trends in Percent Cover of Alaska Huckleberry (Vaal) Plus Important Tree Species (Abam, Tshe, Thpl) Over Time, <u>Abies amabilis/Vaccinium alaskaense</u> Association.

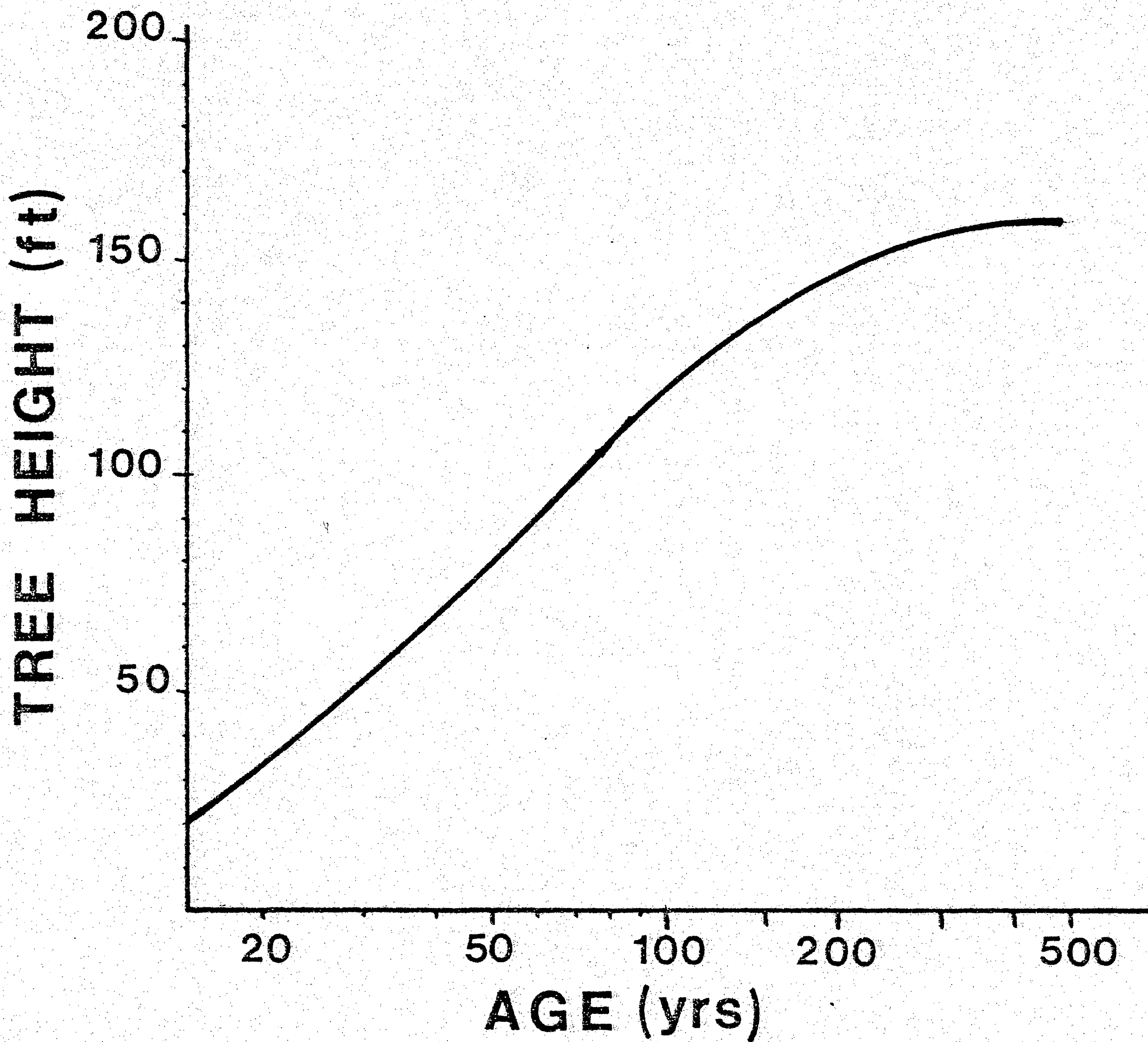

Figure 12. Height Growth Curve for Western Hemlock and Silver Fir on the *Abies amabilis/Vaccinium alaskaense* type.

Vaccinium alaskaense is the clear dominant of the ground vegetation when the type is taken as a whole, averaging 36 percent canopy cover (Table V). Vaccinium parvifolium and Gaultheria shallon can be found on drier portions (phases) of this type while Oplopanax horridum and Rubus spectabilis are often found in the wetter portions.

Important herbs include: Maianthemum dilatatum, Blechnum spicant, Rubus pedatus, Clintonia uniflora, and Cornus canadensis. Table VI shows the trends in species cover.

Timber Productivity

Timber productivity among Abam types is moderate. McArdle and Meyer (1930) site index (applied to all species) averaged 119 while the mean basal area in old-growth plots was 284 ft.^{2}/acre. Top height of dominant trees was calculated to be 122 feet at 100 years (Figure 12). Basal area at 100 years was similarly estimated to be 225 ft.^{2}/ac.

McArdle's and Meyer's (1930) yield table for Douglas-fir predict a basal area of 262 ft.^{2}/ac. at 100 years for site index 122. The yield table of Chambers and Wilson (1978) for western hemlock estimate 280 ft.^{2}/ac. Barnes (1962), however, predicts a basal area of 330 ft.^{2}/ac. at age 100 for site index 122. Wiley (1978a, b) for site index 82 (base 50) predicts a height of 122 feet at 100 years and a basal area (for GSI 200) of about 329 ft.^{2}/acre at 100 years. Considerable variation in basal area for a given site index is apparently possible.

Maximum volume accumulation appears to occur about 400 years for this type in this area. This maximum volume from averaged plot data was about 13,000 ft.^{3}/ac. It is interesting to note that total cover of tree species increases beyond 300 years (Figure 11), but growth volume does not.

Douglas-fir shows good height growth potential in the few stands where it occurred. However, when this type is considered over its entire range, Douglas-fir is found naturally only in limited amounts and then mostly on the drier phases of this type. Both western hemlock and noble fir show better growth potential overall than Douglas-fir on this type. Western hemlock is, therefore, our choice as the best single tree species for the Abam/Vaal h.t. in the Cascades. However, a mixture of hemlock and silver fir is probably most feasible. Suitable seed source of Douglas-fir and noble fir, if available, should only be considered on the drier phases of these types. The drier phases are indicated by plants such as Xerophyllum tenax, Berberis nervosa, Linnaea borealis, Gaultheria shallon, and Vaccinium parvifolium.

Wildlife Relationships

The Abam/Vaal h.t. provides some summer range for deer and elk but very little winter range. Thermal cover is perhaps its main value during summer months. A limited food resource is available from the huckleberries and the succulent herbs. In the Olympics palatability of Vaccinium alaskaense is rated "good" for Roosevelt elk by Schwartz (1939) and is noted to be of "great" importance in their diet. However, stomach analyses have consistently failed to distinguish between Vacciniums. I feel that probably much of what is identified as Vaccinium is V. parvifolium, the red huckleberry, which is nearly universally

browsed at least (by deer) throughout the Forest. _Vaccinium alaskaense_, however, shows limited browsing. For black-tailed deer (Brown 1961) found that red huckleberry was a major browse species, especially in April and May but _V. alaskaense_ was not mentioned in direct browsing observations. This type therefore, is not believed to provide significant browse for either deer or elk. However, some of the herbs such as _Blechnum spicant_, _Tiarella trifoliata_ and _Rubus ursinus_ are commonly eaten by elk (Schwartz 1939) and perhaps deer as well.

Relation to Other Types

The Abam/Vaal Association is one of the most common in western Washington. Nearly all studies of middle elevation forests have recognized this as a major type in their area. It occurs from Central Oregon (Hemstrom 1981) where it is restricted to a few moist stream bottoms throughout the middle elevations of the Cascades and Olympics in Washington and on into British Columbia.

Numerous phases of this type have been or could be recognized, for it spans a considerable geographical and environmental range. The wetter phases would be recognized by _Rubus spectabilis_, _V. ovalifolium_ and _Oplopanax horridum_. The low elevation, dry phases by _Gaultheria shallon_, _Berberis nervosa_ and _Linnaea borealis_. High elevation dry phases by _Vaccinium membranaceum_ and _Xerophyllum tenax_ and modal phases by _Blechnum spicant_, _Clintonia uniflora_, _Cornus canadensis_, and _Rubus pedatus_.

Abies _amabilis_/_Oplopanax_ _horridum_ (Silver fir/Devil's club, Abam/Opho) Association.

The _Abies_ _amabilis_/_Oplopanax_ _horridum_ Association occurs infrequently and sporadically in this area. It is a type of wet places, generally along stream bottoms or in wet seeps on slopes. Two plots were sampled in this type. They occurred in the Miller River and Taylor River drainages although it is not restricted to these areas. Average elevation is 2045 feet aspects were NW and south and slopes averaged 40 percent. This type is typically well protected from all but the most severe fire. Wind too may not play much of a role here because of the topographic positions it favors.

Species Composition and Succession

Analysis of only two old-growth plots in this type shows that western hemlock is the dominant tree species, averaging 43 percent total crown cover. Codominant on this h.t. is silver fir, averaging 25 percent. Western redcedar occurred on both plots, and could be considered a minor component (Table V). The dominant shrub is _Oplopanax_ _horridum_. _Rubus_ _spectabilis_, _Vaccinium_ _alaskaense_ and _Sambucus_ _racemosa_ may also occur. Often there is a rich herb layer under the Devil's club. This includes _Tiarella_ _trifoliata_, _Athyrium_ _filix-femina_, _Blechnum_ _spicant_, _Maianthemum_ _dilatatum_, and _Rubus_ _pedatus_.

Timber Productivity

Timber productivity relations are poorly understood because of the small sample and patchy nature of this type, occurring mainly along streams. Site Index of two stands averaged 135 feet at 100 years, although the basal area averaged only 207 ft^2/ac. (Table IV).

Wildlife Relationships

This type supports many preferred browse, species, especially for elk. Utilization, however, is unclear, but it is probably low because of the elevational and topographic range of this type. Its overall value is for big game in this area probably low although the potential, especially for elk summer range is high. The value for many non-game species is high, as it provides food, water, and protection. It also often contains significant snags.

Relation to Other Types

This type has been described from Mt. Rainier National Park by Franklin et al. (1979) where it was classified as two phases - the valley or stream bottom phase and the slope phase. They sampled 35 plots in this type, and noted that it is an important type in the Park. Henderson et al. (1979) did not recognize this type in either the Hoh or Dosewallips drainages; however, they did recognize a shrub type with limited tree cover, but dominated by _Oplopanax_ _horridum_.

Henderson and Peter (1981d) recognized the Abam/Opho type from the Cedar River drainage in the Washington Cascades. Dyrness et al. (1974) recognized a similar _Chamaecyparis_ _nootkatensis_/_Oplopanax_ _horridum_ type in central Oregon Cascades. Henderson and Peter (1982) recognize the Abam/Opho type based on four plots on the Soleduck District, Olympic National Forest.

Abies amabilis/Vaccinium membranaceum (Silver fir/thinleaf huckleberry, Abam/Vame) Association

The Abies amabilis/Vaccinium membranaceum Association is not common in this area. Only seven plots were sampled. It is found primarily in ecological zones 6, 7 and 8. This corresponds to the precipitation zones with less than 125 inches (318 cm). It becomes more common to the south and northeast where precipitation is less. In the study area it occurred between 3300 and 4000 feet (1000-1220 m) elevation on southerly and westerly aspects (Table IV). Microsite positions and soils are usually well drained.

Fire and Wind Disturbance

Owing to the relatively dry conditions in this type, fires are more common than other Abam Associations. Too few stands are sampled in this to say much more about the fire history. Some of the railroad fires from around the turn of the century (e.g. Granite Mountain, Steven's Pass) plus other burns of about the same time have burned in this type. Much of the Tonga Ridge burn below the Tsme zone is in this type.

Species Composition and Succession

The tree layers are dominated by silver fir with 48% average cover and western hemlock with 49% average cover in old-growth communities. Yellowcedar and Douglas-fir are minor components of old growth communities. Mountain hemlock and red cedar were also encountered (Table V).

Ground vegetation is dominated by thinleaf huckleberry (Vame) which averaged 36% cover in sampled plots. Other common species include Clintonia uniflora, Vaccinium alaskaense, Alnus sinuata, Menziesia ferruginea, Vaccinium parvifolium and Rubus pedatus. Beargrass (Xerophyllum tenax) is a common associate of this type but was not sampled in old-growth communities.

Timber Productivity

Timber productivity potential is low to moderate. Douglas-fir and noble fir can grow here. Dominant tree heights were estimated to be 95 feet (29 M) at 100 years with 195 ft^2/acre ($45m^2$/ha) basal area Table (IV). There was 255 ft 2/ac ($58m^2$/ha) in old-growth stands. Yield capability at 100 years (the approximate time of culmination of MAI) is estimated to be about 61 ft^3/ac/yr. The long natural lag in regeneration on this type can significantly reduce these productivity figures. Regeneration is often a problem on this type. Cold soils combined with hot soil surface temperatures and the desiccation of south slopes puts great demands on young seedlings and germinants.

Wildlife Relations

The Abam/Vame type, especially young, successional stages, is important summer range for many species of wildlife, including deer and bear. The fruits of the thinleaf huckleberry and the flowers of beargrass provide a valuable food source for many animals.

Distribution and Relation to Other Types

The Abam/Vame Association is common in the drier areas in the Olympic and Cascade Mountains, usually on south slopes, ridge tops or other dry microtopographic positions.

It is recognized in various forms from Central Oregon Cascades (Dryness et al 1974), (Hemstrom and Emmingham 1981a), to Mount Rainier (Franklin et al. 1979) to the Olympics (Henderson et al. 1979), (Henderson and Peter 1981a) to British Columbia (Brooke et al. 1970). It was recognized by Henderson and Peter (1981c) as a common type on the White River District. It was recognized for the Upper Middle Fork Snoqualmie River as Abam/Vame/Clun by Del Moral et al. (1976). Several other papers refer to this type, also.

Abies amabilis/Depauperate (Silver fir/Depauperate, Abam/Dep.) Association

The Abies amabilis/Depauperate Association is a somewhat artificial type and represents an unusual situation compared to other types because it is recognized on the basis of what is not present rather than what is. What holds it together as a type is the virtual absence of understory vegetation. The ground vegetation layers are less than 10 percent in the aggregate. Two factors appear to hold this type together - overstocking of the tree layers, causing excessive shading, and topographically dry sites low in the silver fir zone.

The average elevation of 8 plots in this type is 2742 feet, and average slope is 39 percent. Plots occurred on southerly or westerly aspects (Table IV).

Fire and Wind Disturbance

Parts of this widespread type have been affected by some of the recorded fires in the Cascades. Since it typically occurs on drier microsites in the silver fir zone, it is more prone to burning than other, moister habitats. So few fires have burned in the study area it is difficult to characterize its fire relationships further.

Species Composition and Succession

Old-growth as well as natural young growth stands are dominated by western hemlock and silver fir. Douglas-fir is a minor component, apparently depending somewhat on type and severity of disturbance for its abundance. Noble fir was not encountered in the sampling, but it is believed it could grow here.

In younger stands sampled, western hemlock is clearly dominant over silver fir, while in older stands silver fir is more dominant. Douglas-fir assumes a minor and relatively constant role throughout the age sequence sampled. A look at the regeneration of both species indicates that silver fir again has the edge in the later ages, but hemlock, even after 400 years, has enough regeneration to ensure its position in the community.

The ground vegetation layer is so sparse it is impossible to say anything about trends in time. However, some species are frequently encountered. These include Acer circinatum, Clintonia uniflora, Goodyera oblongifolia, Vaccinium parvifolium, V. alaskaense, and Blechnum spicant (Table V).

Timber Productivity

Timber productivity indicators are moderate to low. Average site index (McArdle and Meyer 1930) for all species is 117. Top height for all species was 155 feet at 400 years and 102 feet at 100 years (Table IV).

Basal area of sampled stands is high with a peak of about 272 ft^2/ac at about 400 years. Volume using the relationship: HT x BA/3 reached 14,000 ft^3/ac. with 8,800 ft^3/ac at 100 years. This makes it apparently the most productive of the silver fir types. It has a low site index but a high basal area stockability.

Wildlife Relations

Because of the sparse understory, wildlife forage is very poor. Thermal cover from the often dense overstory is provided but little hiding or other protective cover. Travel is often easy through stands of this type for both man and beast, but little utilization is made along the way.

Distribution and Relation to Other Types

This type, either as an Association or habitat type, is not recognized in the literature. Because of the lack of understory species, it was a puzzle to ecologists for many years. Previous thought held that this was merely a peculiarity or stocking variant of some other type. However, as the evidence accumulates, the depauperate understory stand condition cannot be attributed soley to a dense tree canopy but rather, in many cases, to peculiar topographic-elevational relationships. Although heavy stocking is a characteristic of this type, it is not believed to be the "driving" factor, although some interaction between site and stocking may be at least part of the answer.

This type, therefore, occurs in many other areas studied, including the White River Ranger District. We have also recognized it for the Soleduck Ranger District, Olympic National Forest (Henderson and Peter 1982).

Tsuga heterophylla (Western hemlock, Tshe) Series

The Tsuga heterophylla Series represents about 20,000 acres (8000ha) or about 10% of the study area (Figure 8). It occurs along the lower reaches of the Foss and Miller Rivers, Money Creek and adjacent to the Skykomish Valley below about 2,000 feet (610 m); in the Tolt River Drainage below about 2,220 feet (670 m); in the North and Middle Fork Snoqualmie Rivers below about 1,800 feet (520 m) and up the bottom of the South Fork Snoqualmie River Drainage to about the Asahel Curtis campground, but as far as Denny Creek on the south slopes of Granite Mountain, where it goes up to about 3,400 feet (1040 m) (See Figure 7 and 9).

The western hemlock zone is generally characterized by less than 100 inches (254 cm) of precipitation most of which comes as rain. The summer drought, typical of Western Washington is well expressed in the Tshe zone. There is little snow accumulation during the winter and when spring arrives, soils begin to warm and plants begin to grow early in the year, in contrast to higher zones which are still under snow.

Of the major ecological variables that affect plant distribution and growth (i.e. moisture, temperature, nutrients and light) the pattern of moisture distribution through the ecosystem and through the seasons appears to correlate best with the pattern of community distribution and tree growth. Sites that have the least amount of available water during the spring and summer are typically the poorest sites for tree growth. These sites throughout the Forest are Salal or oceanspray types. Wild rose and beargrass are often found associated with these types. At the wet extreme where there is impeded water drainage productivity can also be low. The best sites have moderate to high precipitation, ample soil water holding capacity or a subsurface water supply. At higher elevations where precipitation increases and a lingering snowpack provides water later into the summer, shortening the drought season, temperature appears to play an increasingly important role. This is not to say that the other ecological factors are not important too, we are only talking about relative importance and the most important variable.

Regeneration is not often a problem in the Tshe zone. Sometimes some drier sites can pose difficulties where seedlings succumb to summer drought. More often the problem is too much regeneration (combination of planted and naturals or a good catch of naturals) or competition from undesirable species such as red alder or salmonberry. Overstocking is most often a problem on drier sites (salal etc.) on gentle slopes. Brush competition is more often a problem on the moist types such as Tshe/Pomu and Tshe/Vaal.

Soils are variable, mostly derived from Granite or metamorphosed sedimentary material.

Timber productivity is moderately good, especially on the moist types, such as Tshe/Pomu, Tshe/Titr-Gydr, certain parts of Tshe/Opho, and Tshe/Vaal. Some extremely high volumes and productivity rates are encountered along some of the well watered toe slopes such as in the North Fork of the Snoqualmie River. On the average, trees (Douglas-fir or western hemlock) can be expected to be about 149 feet at 100 years with an average basal area of 243 ft^2/ac. Volumes should average about 12,000 ft^3/ac.

Douglas fir is the preferred timber species in the western hemlock zone. Western hemlock, western redcedar and red alder can also be grown with the appropriate silvicultural technique (Table I).

Seven Tshe Associations are recognized at this time based on 66 total plots but only 23 old-growth plots. These are western hemlock/Devil's club (Tshe/Opho), western hemlock/salal (Tshe/Gash), western hemlock/Alaska huckleberry (Tshe/Vaal), western hemlock/swordfern (Tshe/Pomu), western hemlock/foam flower - oakfern (Tshe/Titr-Gydr), western hemlock/Oregongrape (Tshe/Bene), and the western hemlock/Depauperate (Tshe/Dep.) Associaions. Of these the Tshe/Pomu is the most common, representing about 40% of the zone in this area. This type is quite productive and most of it has already been cut over. Therefore, most of the communities on the Tshe/Pomu habitat type are seral second growth stands.

Key to the Associations in the *Tsuga heterophylla* (Western hemlock, Tshe) Series

1. Devil's club (Opho) $\geq$ 10% cover . . . . .Tshe/Opho p. 55

1. Not as above. . . . . (2)

    2. Salal (Gash) $\geq$ 10% cover. . . . . .Tshe/Gash p. 56

    2. Not as above. . . . . (3)

        3. Alaska huckleberry (Vaal) $\geq$ 10% cover . . . . .Tshe/Vaal p. 58

        3. Not as above. . . . . (4)

            4. Swordfern (Pomu) $\geq$ 10% cover. . . . . .Tshe/Pomu p. 59

            4. Not as above. . . . . (5)

                5. Foamflower (Titr) and Oakfern (Gydr) each $>$ 2% cover . . . . .Tshe/Titr-Gydr p. 61

                5. Not as above. . . . . (6)

                    6. Oregongrape (Bene) $\geq$ 5% cover . . .Tshe/Bene p. 62

                    6. Not as above. . . . . (7)

                        7. Total shrub and herb cover $<$ 10% . . . . .Tshe/Dep. p. 63

                        7. Not as above-community does not key, go back to lead one and use relative cover instead of absolute cover. If community still does not key, it is probably in seral or disturbed condition or does not belong to Tshe Series or it represents an undescribed type for this area.

Table VIII. Environmental and Physical Values for Associations in the *Tsuga heterophylla* Series.

	Tshe/ Opho n=7	Tshe/ Gash n=11	Tshe/ Vaal n=7	Tshe/ Pomu n=27	Tshe/ Bene n=4	Tshe/ Dep. n=7
Elevation (Ft.)	1910±39*	2450±520	1960±600	1540±490	2370	2540±900
Aspect	S, NW	S, W	SW	All(N)	SE	All
Slope	22±19	60±23	36±12	32±19	43	65±29
Topographic moisture	Wet	Dry	Moist	Modal	Modal	Dry
Site Index (McArdle and Meyer 1930)	131	122±49	145	150±35	130	133
Height at 100 years (Ft.)	151	122	160	168	132	130
Top Height Old-growth (Ft)	220	162	208	220	178	180
BA in Old-Growth (Ft^2/ac)	256	318	256	223	-	300
BA at 100 years (Ft^2/ac)	210	240	250	230	261	300
Volume at 100 years (Ft^3/ac) (Ht x BA/3)	10,500**	9,800	13,300	12,900	11,500	13,000
Volume in Old-Growth (Ft^3/ac)	19,000	17,000	18,000	16,000	15,000	18,000
Average Stand Diameter (Inches)	30	29	27	30	-	24

* Values are ± 1 Standard Deviation
** Values are estimates and should be used for comparison only. They should be viewed as relative productivity estimates.

Table V. Average Coverage Values for Associations in the <u>Tsuga heterophylla</u> Series. "." indicates a coverage less than one percent. Zero values included in averages.

TREES	Abam/Opho n=5	Abam/Gash n=5	Abam/Vaal n=4	Tshe/Pomu n=3	Tshe/Dep. n=3
ABAM*	4	3	1	2	2
PSME	5	29	10	13	18
THPL	22	15	8	8	6
TSHE	65	70	83	75	95
SHRUBS-HERBS					
ACCI	11	1	8	10	.
ACTR	1	1	.	.	
ATFI	8		1	1	
BENE		5	14		1
BLSP	8	5		.	1
CHME		1	.		1
CHUM		.			
CLUN	1	2	.		.
COCA	5	1	3	1	1
GASH		21		.	1
GOOB		.			.
GYDR	1	.	.		
HODI		.			
LIBO2	.	1		.	
MADI	4	1	2	1	.
MEFE	1	2	2	1	
OPHO	36	1	7	3	
OSCH	.				
POMU	1	2	5	17	
PYSE		.	.	.	.
RUPE	3		5	.	
RUSP	2		1	4	
SMST	1	2	.	.	.
TITR	2	.	3	1	
TRLA2					
TROV	.	.			
VAAL	12	14	39	1	2
VAPA	4	5	9	1	1
VISE		.	1	1	
XETE		.			

* See Table XII, Page A-3 for full scientific and common names of these species.

Tsuga heterophylla/Oplopanax horridum (Western hemlock, Devil's club, Tshe/Opho) Association.

The *Tsuga heterophylla/Oplopanax horridum* Association occurs in patches and stringers along first, second and third order streams on wet toe slopes and around springs on middleslopes. It is most common along tributaries to the Middle and North Fork Snoqualmie River and the Miller River. These areas fall within the high precipitation areas associated with ecological zone 5 (Figure 7 and 8). Eight plots were sampled in this area, They averaged 1910 feet (582 m). Slopes were either moderate (40%) or nearly flat. Aspect is not as important as topographic position relative to streams. However, it appears that southerly aspects are favored.

Fire and Wind Disturbance

Because of the wet nature of the Tshe/Opho habitat type and the lushness of the associated plants, this type is often protected from fire.

Species Composition and Succession

Western hemlock and western redceder (Table VIII) dominate the tree layers. Small amounts of Douglas-fir and silver fir may be encountered in the old-growth communities. In the ground vegetation layers, *Oplopanax horridum*, *Ribes bracteosum*, *Rubus spectabilis*, *Vaccinium alaskaense* and *Acer circinatum* dominate. Numerous met site herbs occur beneath the shrubs. These include *Athyrium filix-femina*, *Blechnum spicant*, *Maianthemum dilatatum*, *Tiarella trifoliata* and *Gymnocarpium dryopteris*.

Timber Productivity

Timber productivity potential in this type is difficult to assess because of the patchy nature of the communities and the influence of adjacent streams. Site index indicators are moderate to high averaging 151 feet (46 m) at 100 years although one stand was almost 200 feet (61 m). Some sites with Douglas-fir, however, are better than this and others are poorer, possibly because of disease or disturbance factors. Stocking in old-growth communities appears to be limited with only 210 ft^2/ac of basal area estimated at 100 years. This type tends to be patchy, however, and under management this type may prove to be one of our most productive.

Wildlife Relations

Potential for wildlife values in this type is high. Because of the limited elk herds in areas where this type is more common, utilization is low. Deer may utilize this type for cover and food at certain times of the year, especially winter and early spring. Undoubtedly many non-game species seek food, cover and water here.

Distribution and Relation to Other Types

This type is now widely recognized in Western Washington, but not elsewhere Franklin et al. (1979) recognized it as a common river bottom component of Mount Rainier National Park. Henderson and Peter (1981a, b, d; 1982) have identified this type in areas already covered in this study.

Tsuga heterophylla/*Gaultheria shallon* (Western hemlock/Salal, Tshe/Gash) Association.

The *Tsuga heterophylla*/*Gaultheria shallon* Association is one of the most frequently encountered in Western Washington. However, in the Snoqualmie and adjacent Skykomish drainages it is restricted to only a few topographically or edaphically dry sites. It is most common in ecological zones 7 (Figures 7 and 8) and above and was sampled mostly in the S. Fk. Snoqualmie River drainage. Average elevation of 11 plots in this type in this area was 2450 feet (747 m). Slope averaged 60% on southerly to westerly aspects. Soils are well drained, often gravelly sandy loams. The most common soil mapping unit encountered was SMU 81 (Snider and Wade 1972). Other soils include 7, 8, 63, 83, and 86.

Fire and Disturbance History

Fire history in the Tshe/Gash type is fairly well established for Western Washington. But since it is an infrequent component of the landscape in the study area, we can't say much about it there. Regionally this type burns frequently (about every 150-200 years) and constitutes most of the high fire hazard areas for modern times. In the study area it occurs mostly around the drier fringes. Sampled stands represent fires that burned mostly about 220 and 270 years ago. As in most Tshe types in this area wind is not a consistent disturbance factor.

Species Composition and Succession

The Tshe/Gash type is easily identified by the presence of hemlock regeneration and the dominance of salal (Gash) in the understory. Douglas-fir is the major seral species on this type. Seral hardwoods (Alru, Acma and Rhpu) are usually absent. Hemlock assumes dominance of this type as stands move closer to old-growth conditon. Late in the sere western redcedar becomes noticable in the community and by near-climax stages becomes codominant with hemlock.

In the ground vegetaion layers few species seem to be able to compete with salal when it takes hold of the site. Red huckleberry (Vapa), Oregongrape (Bene) and vine maple (Acci) are usually found associated with salal on the Tshe/Gash h.t.

Timber Productivity

Timber productivity in the Tshe/Gash h.t. is moderate. However, there is considerable variability within this type over its range depending on whether it develops on well drained but also well-watered sites (high productivity) or excessively well drained but not well watered (low productivity) sites.

High productivity Tshe/Gash sites appear to be absent in the Snoqualmie and adjacent Skykomish drainages. Site index for stands in this area from McArdle and Meyer (1930) averaged 122 feet (38.2 m) while the height of dominant Douglas-fir trees based on a reconstructed height growth curve was also 122 feet (Table VII). Basal area was high in sampled stands averaging 240 ft^2/ha ($55.1 m^2$/ha) at 100 years and 318 ($73.0 m^2$/ha) in old-growth. This points out the interesting inverse relationship between site index and basal area noticed by

others in other areas. In wild stands there tends to be a greater basal area accumulation, especially in young stands for lower site stands. A similar relationship is reported by Miles Hemstrom (personal communication) between the drier Cascades and the moister Coast Range of Oregon.

Genrally, Douglas-fir is the preferred timber species. Western hemlock may be able to keep up with Douglas-fir on the dry or moist extremes, but is generally inferior to Douglas-fir on the Tshe/Gash type. Western redcedar can be considered here. Some preliminary results indicate that this is one type which responds well to fertilizer. Because of the stocking relationship mentioned above, special care (thinning) is sometimes needed to keep these stands from overstocking or even stagnating. This is especially true on drier sites in this type.

Wildlife Relations

This type provides some winter range, hiding and thermal cover and forage for both deer and elk. However, deer seem to use the type more than elk. The shrubs found in this type provide some browse year-around, as the type is usually snow-free much of the winter. Overall importance of this widespread type for ungulates is moderate for deer and low for elk.

Relation to Other Types

The Tshe/Gash Association is widely recognized and is one of the most common types in Western Washington and Oregon. Many authors make reference to this type including Spilsbury and Smith (1947); Eis (1962); Dyrness et al. (1974); Franklin and Dyrness (1973); Franklin et al. (1979); Henderson et al. (1979); Henderson and Peter, (1981a, b, c, d); Henderson and Peter (1982).

Tsuga heterophylla/Vaccinium alaskaense (Western hemlock/Alaska huckleberry, Tshe/Vaal) Association.

The Tsuga heterophylla/Vaccinium alaskaense Association occurs along streamcourses and moist slopes just below the silver fir zone. These sites are higher elevation and cooler than Tshe/Pomu, drier than Tshe/Opho and without the winter snowpacks of the Abam/Vaal type. Average elevation was 1960 feet (600 m) for seven plots. Slopes were southwest or stream bottoms and averaged 36%.

Fire and Disturbance History

The Tshe/Vaal Association develops on moist and often protected sites and is much less prone to burn than the Tshe/Gash, Tshe/Bene or Tshe/Dep. types. Ages of pre-management forests indicate fires about 80, 130, 360 and 450 years ago.

Species Composition and Succession

Western hemlock is the dominant tree species on this type even in seral stands. Douglas-fir had up to 30% cover in young (planted) stands but was absent in others. Western redcedar and small amounts of silver fir are present in the stands. The presence of silver fir points up the similarity between this type and the Abam/Vaal type.

Alaska huckleberry is at least codominant in the ground vegetation layers, even early in the sere. Other moist site species such as Oplopanax horridum, Rubus spectabilis, Blechnum spicant and Athyrium filix-femina are often conspicuous. Polystichum munitum was present in most communities, occasionally with a cover greater than 10%.

Timber Productivity

Timber productivity estimators indicate a good potential. However, some stands were quite good. Average site index (McArdle and Meyer (1930) was 145 feet (44 m) and the estimated height at 100 years was 160 feet (49 m). Average top height of old-growth stands was 208 feet (63 m) with two stands going much higher. Basal area in old-growth stands averaged 256 ft^2/ac (59 m^2/ha).

Wildlife Relations

Many preferred browse species occur in seral as well as old-growth stages of this Association. If elk are present, this can represent prime winter range habitat. In the Olympics resident year-round elk herds reside in this type (Kent Jenkins, personal communication). This type represents good potential Roosevelt elk habitat, although elk are absent from most of the study area. It is also moderate to good deer winter range.

Distribution and Relation to Other Types

The Tshe/Vaal type is recognized in the Shelton, Quinault, and Soleduck Districts, Olympic National Forest (Henderson and Peter 1981a, b; 1982) and for the southern portion of the North Bend District, Mt. Baker-Snoqualmie National Forest (Henderson and Peter 1981d) but not for the White River District further to the south. Franklin et al. (1979) did not recognize this type in Mount Rainier National Park; nor did Dyrness et al. (1974) for the Oregon Cascades.

Tsuga heterophylla/Polystichum munitum (Western hemlock/Swordfern, Tshe/Pomu) Association.

The *Tsuga heterophylla/Polystichum munitum* Association is a common and highly productive type of moist and usually toe slope positions. It occurs typically where there is subsurface water supplied to the site, usually on southerly aspects in high precipitation areas (such as the Snoqualmie and adjacent Skykomish drainages), and on northerly aspects in drier areas. It is drier than Tshe/Opho and moister than Tshe/Gash and warmer and drier than Tshe/Vaal. Average elevation in this area was 1540 feet (470 m). Slopes averaged 32%. Twenty seven plots were taken in this area (Table VII), only three of which represented old-growth conditions.

Fire and Disturbance History

The limited number of old-growth plots (n=3) in this type in this area makes it very difficult to reconstruct the fire history here. The three communities, however, appear to have originated following fires about 130, 300 and 450 years ago. These are three of the major burning periods already recognized for Western Washington. The numerous other samples in this type date from early railroad logging to modern timber cutting. Most of this type was cut over early, as it was both accessible, and because of the high productivity of these sites, and contained large timber volumes. Because of the moistness of this kind of site and the lushness of many of its constituent ground vegetation species fires have probably burned less frequently in this type than the average for the Tshe zone. This too may account for the high volumes on this type in virgin forests.

Species Composition and Succession

Douglas-fir (Psme) and alder (Alru) are the major seral species while western hemlock (Tshe) is the dominant old-growth species, although it too plays an important role in some early seral stands. Western redcedar is a minor component of the old-growth communities. The ground vegetation layer is dominated by herbaceous species such as trailing blackberry (Ruur), velvet grass (Hola), pearly everlasting (Anma), and cat's ear (Hyra). Later stages are clearly dominated by swordfern (Pomu). Other species which may be encountered include red huckleberry (Vapa), salal (Gash), deerfern (Blsp), and foamflower (Titr).

Timber Productivity

Timber productivity potential on the Tshe/Pomu habitat type is high. Site index using the curves of McArdle and Meyer (1930) averaged 150 while the estimated dominant tree height at 100 years was 168 (51 m). Gross volume at 100 years is estimated to be about 12,900 ft.^{3}/ac. (Table VII). This volume estimate is based on height and basal area. Basal area of old-growth stands averaged only 223 ft^2/ac (51.2 m^2/ha). Wild stands in this type show surprisingly low basal areas. We do not know at this time whether this represents a stockability limitation of this kind of site or a stocking due to stand history. The brush competition problems often encountered on this type from alder, salmonberry and vine maple suggest young wild stands do not always become fully stocked, and then as these other species fade from the community, Douglas-fir is not able to fill-in the vacated space in the community, although hemlock and cedar would

gradually come in. This would yield few, widely spaced, fast growing trees in a stand which might never be able to "fully occupy" the site. If this is the case, management through stocking control should be able to increase the yield on this habitat type over what wild stands have produced.

Wildlife Relations

The Tshe/Pomu Association in typical old-growth condition provides some cover and forage for large ungulates. Animals will feed on the swordfern (Pomu) if other species are lacking. Also, red huckleberry (Vapa), foamflower (Titr), Devil's club (Opho), and salmonberry (Rusp) may be present in small quantities and utilized.

Seral stages on the Tshe/Pomu h.t., in contrast, often provide good forage, especially in the spring and late winter when food is often limiting. Red alder (Alru), salmonberry (Rusp) plus many forbs and grasses can dominate these stands.

Relation to Other Types

The Tshe/Pomu Association is widely recognized and is one of the most common types in Western Washington and Oregon. Many authors refer to this type including Spilsbury and Smith (1947) (swordfern site type); Eis (1962) (*Polystichum* Association), Franklin and Dyrness (1973); Dyrness et al. (1974); Franklin et al. (1979); Henderson et al. (1979) (Psme-Tshe/Pomu-Oxor c.t.); Henderson and Peter (1981a, b, c, d); Henderson and Peter (1982).

Tsuga heterophylla/Tiarella trifoliata-Gymnocarpium dryopteris (Western hemlock/foamflower-oakfern, Tshe/Titr-Gydr) Association.

This Tsuga heterophylla/Tiarella trifoliata-Gymnocarpium dryopteris Association is recognized for this area on the basis of one plot in the North Fork of the Snoqualmie River drainage. It occurred on a well-watered, fertile toe slope site on a 55% southeasterly slope.

The overstory was dominated by large Douglas-firs mostly about 6 feet (2 m) dbh and about 460 years old. The site tree was 217 feet (66 m) tall. The understory was herb dominated with ony small amounts of Oplopanax horridum, Vaccinium parvifolium and V. alaskaense. The herb layer was dominated by the ferns Blechnum spicant, Polystichum munitum and Gymnocarpium dryopteris and moist site herbs Tiarella trifoliata, T. unifoliata, Maianthemum dilatatum and Clintonia uniflora.

Timber productivity potential, as it was in stands of this type on the White River District (Henderson and Peter 1981c), was very high. Site index was estimated from a single tree to be about 160 but basal area was also high yielding an estimated volume at 100 years of about 16,000 ft^3/ac.

This type is previously recognized on the White River District (Henderson and Peter 1981c). It was not reported by Henderson and Peter (1981d) for the southern North Bend District but it has subsequently been identified there too.

Tsuga heterophylla/Berberis nervosa (Western hemlock/Oregongrape, Tshe/Bene) Association.

The Tsuga heterophylla/Berberis nervosa Association is a minor and tentative type for this area. It is recognized from four second growth communities. It occurs at the upper elevational range of Tshe/Pomu to which it is related. It is also similar to Tshe/Gash but perhaps occurring on finer textured soils. Sometimes it occurs in well-drained topographic positions.

Douglas-fir, western hemlock and western redcedar are dominant trees. Ground vegetation is characterized by Berberis nervosa, Acer circinatum, Cornus canadensis, Maianthemum dilatatum, Vaccinium parvifolium and Viola sempervirens.

Average site index is about 130 feet (40 m) at 100 years. Volume productivity potential is about average for the western hemlock zone. Wildlife and recreational values are moderate to low.

The Tshe/Bene Association is recognized for the White River and southern North Bend Districts (Henderson and Peter 1981c, d). In those areas it is a drier type usually without vine maple and with a more depauperate understory. It was not recognized in Mount Rainier National Park by Franklin et al. (1979). Dyrness et al. (1974) recognize the Pseudotsuga menziesii/Acer circinatum/ Berberia nervosa community type in the Central Cascades in Oregon. Henderson et al. (1979) report an Abgr/Acci-Bene and a Tshe-Psme/Acci-Bene community type in the Olympics.

Tsuga heterophylla/Depauperate (Western hemlock/Depauperate, Tshe/Dep.) Association

The *Tsuga heterophylla*/Depauperate Association is usually found at upper elevations in the Tshe zone where it averages 2540 feet (774 m). It occurs on all aspects, but mostly on drier upper slope positions or steep, well-drained lower slope positions. Average slope was 65%, making it the steepest of the Tshe Associations for this area. Seven plots including three old-growth plots were sampled. Average total understory cover in these three plots was 5%. This type is found more commonly in drier parts of the study area i.e. ecological Zones 6 and 7 (Figures 7 and 8) and in drier portions of the Forest.

Fire History

Too few stands of this type have been sampled to understand the fire history relationships here. One fire about 80 years ago and another about 360 years ago are represented in the plot records. Topographically and climatically this type occurs in areas one would expect to be more prone to fires than the average.

Species Composition and Succession

There is little to be said about the ground vegetation in this type except that there isn't much. In the tree layers Douglas-fir and western hemlock dominate. In the ground vegetation layers *Acer circinatum*, *Berberis nervosa*, *Chimophila menziesii*, *Vaccinium alaskaense*, and *V. parvifolium* are often present.

Timber Productivity

Timber productivity potential is moderate, about the same as the Tshe/Bene type. McArdle and Meyer (1930) site index averaged 133 feet (41 m) at 100 years while the projected average tree height at 100 years was 130 feet (40 m). Basal area stockability is moderate to high for this area with old-growth stands averaging 300 ft^2/ac (69 m^2/ha). Estimated volume at 100 years is a high 13,000 ft^3/ac. Other estimators of stockability (GBA, SDI, etc.) may show this type to have a low growth stockability and that these old-growth stands exhibit quite an excess over what is desirable under management. As an indicator of this overstocking, average stand diameter (Table VII) was only 24 inches (6 dm) in old-growth stands, the smallest of any Tshe zone types.

Distribution and Relation to Other Types

This type is not generally recognized as a kind of ecological site as it is here. In Canada, however, Eis (1962) recognized a "moss" type while others have referred to a "nudum" type. Usually stands with depauperate understory have been considered anomalies of stand history or current (cover) stocking. It was recognized for the Soleduck District, Olympic National Forest, by Henderson and Peter (1982).

Non-Forest Types

Non-Forest communities are classified into Associations by physiognomic type (i.e. shrub types and herb types). These correspond to the Shrubland and Herbaceous Classes of the proposed national RET classification Driscoll et al (1982), although the Phem-Vade type may possibly be better put with the Dwarf-Shrubland class. The others clearly meet the height requirement of the Tall Shrubland Class. The Herbaceous types belong to the Perennial, Tall and Low forb formations and are called Associations here, but more closely meet the classification criteria of Series.

Fifteen non-forest Associations are recognized. These include six shrub types and nine herb types. About half of these Associations represent riparian or wetland ecosystems.

The Shrubland Associations

The six shrubland Associations (Table IX) recognized here can be further classified as 1) talus-avalanche chute communities (Acci/forb, Alsi/forb); 2) middle to low elevation streamside communities (Opho/fern, Ribr/forb); and 3) subalpine low shrub communities (Phem-Vade, Vame-Vade).

Key to the Shrubland Associations

1. Red heather (Phem) and blueleaf huckleberry (Vade) both present, with a combined cover of $\geq$ 20%, high elevation	Phem-Vade	p. 68
1. Not as above	(2)	
2. Thinleaf huckleberry (Vame) codominant with Vade, each with a cover of $\geq$ 10% high elevations . .	Vame-Vade	p. 69
2. Not as above	(3)	
3. Devil's club (Opho) dominant and $\geq$ 20% cover, riparian	Opho/fern	p. 70
3. Not as above	(4)	
4. Stinking black currant (Ribr) $\geq$ 20% cover, usually riparian, at least wet. .	Ribr/forb	p. 71
4. Not as above	(5)	
5. Vine maple (Acci) $\geq$ 20%, Avalanche chutes and talus slopes.	Acci/forb	p. 72
5. Sitka alder (Alsi) $\geq$ 20%, Avalanche chutes and talus slopes.	Alsi/forb	p. 73

Table IX. Physical Site Values and Average Coverages for Important Species in Shrubland Associations

	ACCI/FORB n=10	ALSI/FORB n=7	PHEM/VADE n=10	VAME/VADE n=2	RIBR/FORB n=3	OPHO/FERN n=3
Elev.	2580$\pm$790	341$\pm$390	5120$\pm$560	5120$\pm$339	3390$\pm$422	3160$\pm$409
Aspect.	SE,SW	S,NW	S,W	S,W	NE,SE	NW,E
Slope	55$\pm$17	45$\pm$21	34$\pm$30	85$\pm$28	15$\pm$15	37$\pm$32
<u>Trees</u>						
ABAM			•	•		2
CHNO	•		3	•		
TSHE	•					5
TSME		•	4		1	
<u>Shrub & Herbs</u>						
ACCI	68	4				
ACTR		4				
AGSC			4			
ALSI	3	69			•	5
ARLA	•			11		
ASCA3	•				3	•
ATFI	11	11			9	39
BRPA		1				
CABI					10	•
CAME		•	11			
CAME2		•			1	
CANI2			2			
CIAL	•	•			1	2
CLUN	•	2				•
DEAT			6			
EPAL			•		1	•
EPPA				3		
ERMO			5			
GAAP	•	•				1
GATR	1	•			6	2
GYDR					10	5
JUCO4				2		
LULA				4		
LUPE			7	•		
MEPA	•	2			3	3
MOSI	•	2				•
OSCH					2	
OPHO	1	6			3	53
PEDA	•			3		
PHEM			37	2		
POBI			•	2		
POMU	•					2
PTAQ	24	27				
RIBR		•			73	7
RILA	•	1				•
RULA		•		1		
RUPA	11	2				
RUSP	7	9			27	21
SALIX	3					

	ACCI/FORB	ALSI/FORB	PHEM/VADE	VAME/VADE	RIBR/FORB	OPHO/FERN
<u>Shrub & Herbs</u>						
SANGU					3	
SARA	2	2			1	
SETR					1	
SMST	.	4				1
SOSI		3	.	5	2	
SPDE			2	3	.	
STCR		.				1
STRO	.	5			.	.
TITR					.	1
TIUN					2	10
TOME	11	.			1	5
TROV	.	.			.	1
VAAL	.	.	3			1
VADE			18	30		
VAME		.	2	30	.	
VASI		1	.	3	.	
VIGL	.	3			11	3

Phyllodoce empetriformis - *Vaccinium deliciosum* (Red heather - Blueleaf huckleberry, Phem-Vade) Association

The *Phyllodoce empetriformis* - *Vaccinium deliciosum* Association occurs at subalpine elevations, mostly from 4500 to 5500 feet (1372 to 1670m). It is the typical and most common subalpine parkland type in this area. It typically develops on raw, stoney soil material; either glacial till or raw colluvium or scree. It can pioneer on raw stoney slopes recently free of permanent snow fields or glaciers. In other areas it is more mature and occurs on more stable and partially weathered protalus or other periglacial material, or colluvium.

Some communities of this type have been invaded by trees recently during the current warming trend. This warming trend may have culminated during the 1930's when the peak of tree establishment apparently occurred Franklin et al. (1970). This tree invasion of these heather-huckleberry communities is seen as a temporary fluctuation due to current climatic conditions. With the return to cooler times as we experienced only couple of hundred years ago, we should see retrogressive pressure on these communities and most of these trees should die.

The fleshy capsules of the heather and the berries of the huckleberry provide food for many small mammals and birds, although mountain goats and black-tail deer appear to make little use of this type.

The vegetation is clearly dominated by heather (both Phem and *Cassiope mertensiana*) and the low huckleberry *Vaccinium deliciosum*. Some herbs that may occur in the community include *Luctkea pectinata* (especially on seral or disturbed sites) *Erythronium montanum* (conspicuous early in the season), *Deschampsia atropurpurea* and *Carex nigricans*. Seedling sized individuals of Tsme, Abla2, or Chno are often encountered.

This common type is recognized by Henderson (1974) for Mount Rainier National Park and by several other authors.

Vaccinium membranaceum - _Vaccinium deliciosum_ (Thinleaf huckleberry - Blueleaf huckleberry, Vame-Vade) Association

The _Vaccinium membranaceum_ - _Vaccinium deliciosum_ Association is tentatively recognized as an association based on two plots in the sampled area. The successional status of this type is not clear. It is probable that it represents a long-term stable, but seral stage leading to Tsme/Vame climax. Fires in this type may initiate the Vame-Vade community, which may persist for many years before trees get re-established.

This type occurred on steep, southwesterly slopes about 5100 feet (1554m).

The two huckleberries (Vame and Vade) are codominant (Table X). _Sorbus stichensis_, _Arnica latifolia_, _Lupinus latifolius_, _Valeriana sitchensis_ and _Polygonum bistortoides_ may also occur.

Oplopanax horridum/Fern (Devil's club/Fern, Opho/Fern) Association

The *Oplopanax horridum*/Fern Association occurs at low to moderate elevations (3160 feet, 963m) on moderate (37%) slopes on northwesterly to easterly aspects in stream bottoms or on well-watered mid-slope springs or seeps. Three plots of this type have been sampled so far in the Cascades.

Oplopanax horridum is a favorite food of Roosevelt elk. This community, therefore can develop where elk influence is minor. Other animal use is unclear. However, this type can provide food from herbs and berries cover and water and, therefore, should be important habitat for some animals. This type often develops as an impenetrable thicket. Some communities on moderately steep slopes (40%) with a stream running through and slippery boulders underfoot and 100 percent cover of Devil's club lead high or taller can be a forbidding area to try to sample (or anything else).

Devil's club is the clear dominant of the tall shrub layer, however, *Rubus spectabilis*, *Ribes bracteosum* and *Alnus sinuata* are usually also present (Table X). Ferns such as *Athyrium filix-femina* and *Gymnocarpium dryopteris* and herbs such as *Tiarella unifoliata* and *Tolmiea menziesii* dominate the ground layer.

Ribes bracteosum/Forb (Stinking black currant/Forb, Ribr/Forb) Association.

The Ribes bracteosum/Forb Association is found at moderate elevations (3390 feet, 1033m) on gentle, easterly, wet streamside sites. Three plots of this type were sampled in this area. It is considered a riparian community. The community is often very thick and difficult to make your way through. It may be a refuge for several small animals. Evidence of burrowers and surface mammals are often present. These sites often flood during runoff periods, leaving a thin layer of sand or silt on the soil surface. The absence of leaf litter accumulations in this case probably greatly affects the microbial populations and thus nutrient and organic matter turnover and productivity.

The shrub layer is dominated by Ribr plus Rubus spectabilis and sometimes small amounts of Oplopanax horridum. Herbs include the ferns Gymnocopium dryopteris, and Athyrium filix-femina, plus Caltha biflora, Galium triflorum, Viola glabella and Asarum caudatum.

Acer circinatum/Forb (Vine maple/Forb, Acci/Forb) Association

The Acer circinatum/Forb Association is found primarily on tables, rock slides and lower slopes of avalanche chutes mostly from 2000-3000 feet (610-915 m). It often occurs immediately below the Alsi/Forb type and intergrades with it at the ecotone. These sites are often well-watered by subsurface streams flowing through the rocks or occasionally coming to the surface. Often, though they give the appearance of being quite dry. Ten plots of this type have been sampled.

Dominant understory forbs include Athyrium filix-femina, Cirsium alpinum, Galium triflorum, Pteridium aquilinum, Tolmeia menziesii, Streptopus roseus, and Viola glabella. The shrubs Alnus sinuata, Oplopanax horridum, Rubus parviflorus, and Rubus spectabilis may also occur.

Alnus sinuata/Forb (Sitka alder/Forb, Alsi/Forb) Association

The Alnus sinuata/Forb Association is found primarily on tables, rockslides and upper slopes of avalanche chutes mostly from 3000-5000 feet (915-1525 m). It often occurs immediately above the Acci/Forb type and intergrades with it at the ecotone. These sites are characterized by moderate snowpack accumulations and are also often well-watered by subsurface streams flowing through the rocks. Seven plots of this type have been sampled.

Common shrubs besides Alsi include Oplopanax horridum, Rubus spectabilis, Sambucus racemosa and Acer circinatum. Herbs include Athyrium filix-femina, Achlys triphylla, Streptopus roseus, Smilacina stellata and Viola glabella.

The Herbland Associations

Nine Herbaceous Associations are recognized to date from sampling on the White River, North Bend and parts of the Skykomish Districts.

These types can be further characterized as being either wet sedge (or sedge-like) meadows (Cani2, Cale5, Cain5, Erpo2, and Scmi); wet herb communities (Cabi, Cosc) or subalpine herb meadows (Vasi, Fevi/Lula).

Key to the Herbland Associations

1. Communities of wetlands, often lake margins or filled-in ponds, sedge or sedgelike taxa usually dominate . . . . (2)

    2. Small-flowered rush (Scmi) $\geq$ 15% cover . . . . . Scmi p. 76

    2. Not as above . . . . (3)

        3. Cotton sedge (Erpo2) $\geq$ 10% cover . . . . . . Erpo2 p. 77

        3. Not as above . . . . (4)

            4. Lenticular sedge (Cale5) $\geq$ 25% cover . . Cale5 p. 78

            4. Not as above . . . . (5)

                5. Interior sedge (Cain5) $\geq$ 20% cover . Cain5 p. 79

                5. Black sedge (Cani2) $\geq$ 20% cover. . . Cani2 p. 80

1. Communities otherwise, herb or grass dominated, usually drier. . . . . (6)

    6. Communities of wet or streamside sites . . . . . (7)

        7. Scouler's corydalis (Cosc) $\geq$ 40% cover . . . Cosc p. 81

        7. White marsh marigold (Cabi) $\geq$ 20% cover. . . Cabi p. 82

    6. Subalpine communities of moist to dry sites, but not wet . . . . (8)

        8. Sitka valerian $\geq$ 15% cover . . . . Vasi p. 83

        8. Not as above . . . . (9)

            9. Green fescue (Fevi), subalpine lupine (Lula and sometimes Aster (Asle2) codominants. . . . . Fevi-Lula p. 84

            9. Not as above, undescribed Association or successional stage for this area.

	CANI2	CALES	CAIN5	CABI	ERPO2	SCMI	VASI	COSC	FEVI-LULA
	n=10	n=7	n=3	n=3	n=3	n=2	n=5	n=2	n=6
Elev.	4910±510	4610±910	3410±642	3610±889	4280±11	2210±1420	4930±44	3570±686	5510±230
Aspect	flat	flat-NW	flat	SW	flat	flat	NE, SW	SE, SW, flat	SE, SW
Slope	flat	flat-45	flat	5.7±4	flat	flat	42±35	25±35	53±47
<u>Trees</u>									
ABAM					.		1	5	
ABLA2							1		2
TSHE								6	
TSME	1	.	.		1		1		.
<u>Shrub & Herbs</u>									
AGOR		.	.	1					
ANCA				25		1			
ARLA							1		1
ASFO									3
AFTI				4		2	1		
BLSP				.				2	
BROMU				8					2
BRVU									5
CABI	1	6	10	65	10				
CACA		1	6		1				
CACO			7						
CAIN5			50	4	.	1			
CALES	4	52	1	17	7	3	1		
CANI2	68	2	3		6		.		
CAPA3							1		1
CAREX		1		4	.				
CARO									2
CASC5		10							
CASP	10				1		1		1
CAST						2			
CAVE			2	2					
CIAL						2			
COSC								97	
DAIN					1				.
DEAT	1	1					3		1
DOJE	1		10	4	2				
DRAU2							.		
ELCL							.	5	
ELPA			1	1	8				3
EPAL	1	.			3	2			
EPAN				1					
EQAR		.		1		1			8
ERMO	1								
ERPE	2	1	1	5	5		6		1
ERPO2			1		53		2		10
FEVI									24
GLEL		.		.		4			
HADI2				1					
HASA		.		1		1			
HYAN		.	23	5	4				
HYTE									
JUEF								5	
JUKE			1			3			
JUME	.	1	1	1					
KALM1					1				
LICA2									
LIGR	1	.							2
LULA					.		7		1
LUPE	1						5		17
MIOV							1		
OESA								15	
OPHO						4			
PECO								3	
PEGR									2
PHAL		2	.	1	3				
PHEM	2		.		1				
POBI	1	7		1			3		2
POFL2	1				6		3		2
PONU						1	1		.
PUPA						25			
DOJE	1		10	4	2				
RUPE							.		
RUSP		.		8		10	.	3	
SALIX				1		1		2	
SCMI						58			
SETR		.	.	2			4		
SOSI	.			3	.		.		.
SPAN		2			2				
SPDE	.	1	6	1	5		3		1
STME2						29			
TIUN						1	1	3	
TOGL			8						
TOME						13		10	
VADE	4		.		1		5		18
VASI				.			56		4
VEVI		1		1			17		1
VIGL				.		10			
VIOLA		.	2		9				

Scirpus microcarpus (Small-flowered rush, Scmi) Association

The *Scirpus* *microcarpus* Association is a specialized type characterized by Scmi plus numerous other hydrophytes. It occurs mainly in backwater areas off streams and sloughs. Standing water, at least most of the year appears necessary for the development of this type. Soils are depositional alluvial and highly organic. Other characteristic species include Pupa, Tome, Vigl, Rusp, Glel, Oesa and Cale5.

Eriophorum polystachion (Cotton sedge, Erpo2) Association

The *Eriophorum polystachion* Association occurs on certain alluvial soils in filled-in lakes or ponds at moderately high elevations. Many subalpine wet site species occur with the cotton sedge. These can include *Caltha biflora*, *Carex lenticularis*, *Carex nigricans*, *Eleocharis pauciflorus*, *Viola palustris* and *Hypericum anagalloides*.

This type as recognized here also occurs in Mount Rainier National Park, where it was sampled but not described by Henderson (1974). In that study it was lumped with the similar *Carex nigricans* type.

Carex lenticularis (Lenticular sedge, Cale5) Association

The _Carex lenticularis_ Association occurs in wet areas around middle to high elevation lakes or ponds in similar situations to the Erpo2 type. Seven plots have been taken in this type from the White River to the Skykomish. It is one of the more commonly sampled subalpine and montane wet sedge meadows. It does not cover significant acreage, however, and is restricted to a limited and quite specific wetland situation.

In addition to _Carex lenticularis_, _Carex scopulorum_, _Caltha biflora_ and _Polygonum bistortoides_ were encountered.

Carex interior (Interior sedge, Cain5) Association

The *Carex interior* Association is a wetland type found at montane elevations at the edge of lakes and ponds and in filled-in ponds where there are still potholes of open water. Numerous wet site sedges are found associated with Cain5. They include *Carex vesicaria*, *Carex nigricans* and *Carex lenticularis* plus *Caltha biflora*, *Calamagrostis canadensis*, *Dodecatheon jeffreyi*, *Hypericum anagalloides* and *Tofieldia glutinosa*.

Carex nigricans (Black sedge, Cani 2) Association

The _Carex nigricans_ Association is one of the more commonly encountered subalpine type in the Cascades and Olympics. It is reported by several authors including Henderson (1974) and Henderson et al. (1979). Large areas of this type are rare. Typically it occupies small basins or filled-in ponds in a subalpine meadow mosaic. It is often surrounded by heather-huckleberry (Phem-Vade) or herb meadows (Vasi, Vasi-Lula). Theses basins or depressions usually fill with snow. Thus, they support deeper than average snow depths and may melt out later than adjacent communities.

Sometimes members of this type are nearly pure swards of Cani2. Other times there may be minor amounts of species such as _Carex spectabilis_, _Carex lenticularis_, _Phyllodoce empetriformis_, _Vaccinium deliciosum_, _Potentilla flabellifolia_ or _Aster alpigenus_.

Corydalis scouleri (Scouler corydalis, COSC) Association

The *Corydalis scouleri* Association was sampled twice in moist, montane stream bottoms in the White River District. It is dominated by Cosc and a few other moist site herbs. Shrubs and trees are typically absent, although they may hang over or encroach along the edges.

Caltha biflora (White marsh marigold, Cabi) Association

The *Caltha biflora* Association is a low subalpine, upper montane wetland type that occurs on warm, gentle southwest aspects which are well-watered from seeps, springs or streams.

It is not uncommon but occurs in small patches, often near lakes. Composition of this type is more diverse than most of the wet sedge communities with which it is closely related. Besides high coverage of Cabi, there is often significant amounts of *Carex lenticularis*, *Angelica canbyi*, *Erigeron peregrinus*, *Viola palustris*, *Sanguisorba sitchensis*, *Hypericum anagalloides* and *Senecio triangularis*.

Valeriana sitchensis (Sitka valerian, Vasi) Association

The *Valeriana sitchensis* Association is a common and conspicuous subalpine meadow throughout the Cascades and Olympics of Washington. It develops best on accumulations of fine textured (loam) soil rather than the till and strong colluvium common at these elevations.

It is a showy type with such species as Vasi, *Lupinus latifolius*, *Erythronium montanum*, *Ligusticum grayi*, *Polygonum bistortoides*, *Senecio triangularis* and *Veratrum viride*. In Mount Rainier National Park this type was recognized as the Lupine-Valerian (Lula-Vasi) and the Veratrum-valerian (Vevi-Vasi) types (Henderson 1974).

Festuca viridula - _Lupinus latifolius_ (Green fescue - subalpine lupine, Fevi-Lula) Association

The _Festuca viridula_ - _Lupinus latifolius_ Association represents the dry end of the environmental spectrum for the non-forest types described here. Drier types exist in the area, but are not sufficiently sampled to present here. They are characterized by such species as Penstamon spp., _Juniperus communis_, _Festuca idahoensis_, _Sedum divergens_ and _Phlox diffusa_.

The Fevi-Lula type occurs on moderate to steep southerly slopes in Mount Rainier National Park (Henderson (1974) and throughout most of the Cascades in Washington, but is rarely sampled in higher precipitation zones.

It occurs on dry, subalpine sites in areas of less than 120 inches (Figure 2). It is rarely found on Granite bedrock and becomes more common on the metamorphics north of Stevens Pass Highway. In this area it can be located on air photos by its distinctive signature.

It provides some summer range for ungulates such as deer and goats and habitat for burrowing animals such as marmots and pocket gophers.

Fescue and lupine were the most common species, however, _Vaccinium delicosum_, _Valeriana sitchensis_, _Erigeron peregrinus_, _Epilobium angustifolium_, _Bromus vulgaris_ and _Elymus glaucus_ were also encountered.

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APPENDIX

CONTENTS | PAGE

Threatened, Endangered and Sensitive Plants, Snoqualmie and Adjacent Skykomish River Drainages.

There are 88 plant species or varieties on the Regional Forester 1980 Sensitive Plant List that occur on or adjacent to the Mt. Baker-Snoqualmie National Forest. These species are listed in Table XI. There are also 18 Plant Taxa in Washington State which are listed in the Federal Register as Candidate Endangered Plants, and 59 listed as candidate threatened.

None of the candidate threatened or endangered plants are known to occur on the Mt. Baker-Snoqualmie National Forest.

Two of the Regional Forester's sensitive species are known from the Snoqualmie and adjacent Skykomish drainages.

Gentiana douglasiana is known from at least one location near Snoqualmie Pass. This species has not been relocated recently and there is some concern that highway construction may have eliminated it from the area.

Habenaria orbiculata is also known from the lower Miller River, near the ecotone between the silver fir and western hemlock zones.

Other species known from nearby, but not yet reported from the study area include *Pleuricospora fimbriolata* from the Green River; *Eriogonum umbellatum* and *Lycopodium alpinum* from near Stevens Pass and *Thelypteris nevadensis* from near Garland Mineral Spring.

TABLE XI. SENSITIVE PLANTS MT. BAKER-SNOQUALMIE NATIONAL FOREST

Agrostis aequivalvis
Arabis lemmonii
Arenaria paludicola
Arnica nevadensis
Arnica rydbergii
Asplenium viride
Aster curtus
Aster sibiricus
Boytrychium boreale
Boytrychium lanceolatum
Calamagrostis howellii
Calamagrostis tweedyi
Campanula lasiocarpa
Carex capitata
Carex comosa
Carex limnophila
Carex livida
Carex raynoldsii
Carex scirpoidea scirpoidea *
Cassiope stelleriana
Castilleja cryptantha
Castilleja parviflora albida
Castilleja suksdorfii *
Cimicifuga laciniata
Claytonia lanceolata chrysantha
Collinsia sparsiflora bruciae
Coptis asplinifolia
Draba aurea
Draba aureola
Draba incerta
Dryas drummondii
Dryas octopetala hookeriana
Eburophyton austiniae
Elmera racemosa puberulenta
Erigeron compositus discoideus
Eriogonum umbellatum hypoleim
Eriophyllum lanatum achillaeoides
Frillaria camschatcensis
Gentiana douglasiana
Gentiana glauca
Habenaria orbiculata
Hemitomes congestum
Hulsea nana
Impatiens aurella
Juncus supiniformis *
Juncus supinus *
Ivesia tweedyi **
Limosella acaulis *
Lobella dortmanna *
Loiseleuria procumbens
Lomatium bradshawii
Lomatium watsonii
Luina serpentina *
Luina stricta
Luzula arcuata
Lycopodium alpinum
Lycopodium inundatum *
Lycopodium obscurum
Montia diffusa *
Pedicularis rainierensis
Penstemon lyallii
Petasites sagittatus
Plantago macrocarpa *
Platathera unalascensis ssp. maritima *
Poa grayana *
Poa leptocoma paucispicula
Poa rupicola
Polygonum viviparum
Polystichum kruckebergii
Polystichum lemmonii
Ranunculus cooleyae
Rhinanthus crista-galli
Salix arctica
Saxifraga cernua
Saxifraga debilis
Saxifraga integrifolia apetala *
Saxifraga lyallii
Saxifraga oppositifolia
Scirpus cyperinus brachypodus
Sedum lanceolatum
Senecio elmeri
Senecio flettii
Silene suksdorfii
Synthyris schizantha
Tauschia sticklandii
Trollius laxus **
Veronica anagallis-aquatica *
Woodwardia fimbriata *

* On R-6 sensitive plant list, but not listed for Mt. Baker-Snoqualmie N.F., listed by Washington Natural Heritage Program as occurring in this area.

** On R-6 sensitive plant list, but not listed for Mt. Baker-Snoqualmie N.F. Identified on adjacent Mt. Rainier National Park by area ecologist, may also occur on Forest.

TABLE XII. COMMONLY OCCURRING PLANTS OF FORESTED HABITATS ON THE MT. BAKER-SNOQUALMIE NATIONAL FOREST

TREES

TRI code	Scientific Name	Common Name
ABAM	Abies amabilis	Pacific silver fir
ABGR	Abies grandis	Grand fir
ABLA2	Abies lasiocarpa	Subalpine fir
ABPR	Abies procera	Noble fir
ACMA	Acer macrophyllum	Bigleaf maple
ALRU	Alnus rubra	Red alder
CHNO	Chamaecyparis nootkatensis	Alaska yellowcedar
PIEN	Picea engelmannii	Englemann spruce
PISI	Picea sitchensis	Sitka spruce
PIAL	Pinus albicaulis	Whitebark pine
PIMO	Pinus monticola	Western white pine
POTR2	Populus trichocarpa	Black cottonwood
PSME	Pseudotsuga menziesii	Douglas-fir
RHPU	Rhamnus purshiana	Cascara buckthorn
SASC	Salix scouleriana	Scouler willow
TABR	Taxus brevifolia	Pacific yew
THPL	Thuja plicata	Western redcedar
TSHE	Tsuga heterophylla	Western hemlock
TSME	Tsuga mertensiana	Mountain hemlock

SHRUBS

ACCI	Acer circinatum	Vine maple
ACGL	Acer glabrum	Rocky Mt. maple
ALSI	Alnus sinuata	Sitka alder
AMAL	Amelanchier alnifolia	Saskatoon, serviceberry
ARCO3	Arctostophylos columbiana	Hairy manzanita
ARUV	Arctostaphylos uva-ursi	Bearberry, Kinnikinnick
BENE	Berberis nervosa	Low Oregon grape
CAME	Cassiope mertensiana	White Mt. heather
COCO	Corylus cornuta	California hazelnut
CONU	Cornus nutallii	Pacific dogwood
GASH	Gaultheria shallon	Salal
HODI	Holodiscus discolor	Oceanspray
JUCO4	Juniperus communis	Common juniper
LOIN	Lonicera involucrata	Black twinberry
MEFE	Menziesia ferruginea	Rusty menziesia, Fool's huckleberry
OECE	Oemeleria cerasiformis	Indian plum
OPHO	Oplopanax horridum	Devil's club
PAMY	Pachistima myrsinites	Myrtle pachystima, Mt. lover
PHEM	Phyllodoce empetriformis	Red mountain heather
PREM	Prunus emarginata	Bitter cherry

TRI code	Scientific Name	Common Name
RHAL	Rhododendron albiflorum	Cascades azalea, white rhododendron
RIBR	Ribes bracteosum	Stink currant
RIHO	Ribes howellii	Mapleleaf currant
RILA	Ribes lacustre	Prickly currant
RISA	Ribes sanquineum	Red-flowering currant
RIVI	Ribes viscosissimum	Sticky currant
ROGY	Rosa gymnocarpa	Baldhip rose
RONU	Rosa nutkana	Nootka rose
RULE	Rubus leucodermis	Whitebark raspberry, Blackcap
RUPA	Rubus parviflorus	Western thimbleberry
RUSP	Rubus spectabilis	Salmonberry
SARA	Sambucus racemosa	Coast red elderberry
SOSC2	Sorbus scopulina	Cascade mountain ash
SOSI	Sorbus sitchensis	Sitka mountain ash
SPDE	Spiraea densiflora	Subalpine spiraea
SPDO	Spiraea douglasii	Douglas spiraea
SYAL	Symphoricarpos albus	Common snowberry
SYMOH	Symphoricarpos mollis hesperius	Creeping snowberry
VAAL	Vaccinium alaskaense	Alaska huckleberry
VADE	Vaccinium deliciosum	Blue-leaf huckleberry
VAME	Vaccinium membranaceum	Thin-leaved huckleberry
VAOV	Vaccinium ovalifolium	Oval-leaf huckleberry
VAOV2	Vaccinium ovatum	Evergreen huckleberry
VAPA	Vaccinium parvifolium	Red huckleberry
VASC	Vaccinium scoparium	Grouse whortleberry

HERBS

ACMI	Achillea millefolium	Western yarrow
ACTR	Achlys triphylla	Vanillaleaf
ACRU	Actaea rubra	Baneberry
ADBI	Adenocaulon bicolor	Pathfinder
ADPE	Adiantum pedatum	Maidenhair fern
ANMA	Anaphalis margaritacea	Common pearly-everlasting
ANLY2	Anemone lyallii	Nine-leaved anemone
ANOR	Anemone oregana	Oregon anemone
ANLY	Angelica lyallii	Lyall's angelica
ANMI	Antennaria microphylla	Rosy pussy-toes
AQFO	Aquilegia formosa	Red columbine
ARLE	Arabis lemonii	Lemon's rockcress
ARMA3	Arenaria macrophylla	Bigleaf sandwort
ARCO	Arnica cordifolia	Heartleaf arnica
ARLA	Arnica latifolia	Broadleaf arnica
ASCA3	Asarum caudatum	Wildginger
ATFI	Athyrium filix-femina	Lady fern
BLSP	Blechnum spicant	Deer fern
BRSI	Bromus sitchensis	Alaska brome
BRVU	Bromus vulgaris	Columbia brome
CABI	Caltha biflora	White marshmarigold

TRI code	Scientific Name	Common Name
CASC2	Campanula scouleri	Scouler's hairbell
CADE	Carex deweyana	Dewey's sedge
CAGE	Carex geyeri	Elk sedge
CAIN5	Carex interior	Inland sedge
CAME2	Carex mertensii	Merten's sedge
CLUN	Clintonia unifora	Queen's cup
COLA	Coptis laciniata	Cutleaf goldthread
COMA3	Corallorhiza maculata	Spotted coral-root
COME	Corallorhiza mertensiana	Merten's coral-root
COST2	Corallorhiza striata	Striped coral-root
COCA	Cornus canadensis	Bunchberry
COSC	Corydalis scouleri	Scouler's corydalis
DIFO	Dicentra formosa	Pacific bleedingheart
DIPU	Digitalis purpurea	Foxglove
DIHO	Disporum hookeri	Hooker's fairybell
DISM	Disporum smithii	Smith fairybell
DRAU2	Dryopteris austriaca	Spreading woodfern
EPAN	Epilobium angustifolium	Fireweed
EPGL	Epilobium glaberrimum	Common willow-herb
EPMI	Epilobium minutum	Small-flowered willow-herb
EPPA	Epilobium paniculatum	Autumn willow-herb
EQAR	Equisetum arvense	Common horsetail
ERGR	Erythronium grandiflorum	Yellow fawnlily
ERMO	Erythronium montanum	Avalanche fawnlily
EROR	Erythronium oregonum	Giant fawnlily
FERU	Festuca rubra	Red fescue
FRVE	Fragaria vesca	Woods strawberry
FRVI	Fragaria virginiana	Broadpetal strawberry
GAAP	Galium aparine	Catchweed bedstraw
GAOR	Galium oreganum	Oregon bedstraw
GATR	Galium triflorum	Fragrant bedstraw
GOOB	Goodyera oblongifolia	Western rattlesnake plantain
GYDR	Gymnocarpium dryopteris	Oak fern
HADI2	Habenaria dilatata	White bog-orchid
HIAL	Hieracium albiflorum	White flowered hawkweed
HOLA	Holcus lanatus	Velvet grass
HYTE	Hydrophyllum tenuipes	Slender-stemmed waterleaf
HYRA	Hypocharis radicata	Hairy cat's ear
HYMO	Hypopitys monotropa	Pinesap
JUEF	Juncus effusus	Common rush
LAMU	Lactuca muralis	Wall lettuce
LIBO2	Linnaea borealis	Twinflower
LICA2	Lister caurina	Northwest listera
LICO2	Listera convallarioides	Broad-lipped twayblade
LICO3	Listera cordata	Heart-leaf twayblade
LUPA	Luzula parviflora	Small flowered woodrush
LYCL	Lycopodium clavatum	Ground pine
LYAM	Lysichitum americanum	Skunk cabbage
MADI	Maianthemum dilatatum	Beadruby
MESU	Melica subulata	Alaska oniongrass
MIBR	Mitella breweri	Brewer's mitrewort
MOSI	Montia siberica	Candyflower
OSCH	Osmorhiza chilensis	Mountain sweet-cicely

TRI code	Scientific Name	Common Name
OXOR	Oxalis oregana	Oregon oxalis
PERA	Pedicularis racemosa	Leafy lousewort
PEFR	Petasites frigidus	Sweet coltsfoot
PHPR	Phleum pratense	Common timothy
POPR	Poa pratense	Kentucky bluegrass
POGL4	Polypodium glycorrhiza	Licorice fern
POMU	Polystichum munitum	Swordfern
PRVU	Prunella vulgaris	Self-heal
PTAQ	Pteridium aquilinum	Bracken fern
PTAN	Pterospora andromedea	Pinedrops
PYAS	Pyrola asarifolia	Common pink pyrola
PYPI	Pyrola picta	Whitevein pyrola
PYSE	Pyrola secunda	One-sided pyrola
PYUN	Pyrola uniflora	Woodnymph
RARE	Ranunculus repens	Creeping buttercup
RULA	Rubus lasiococcus	Dwarf bramble, trailing b.
RUNI	Rubus nivalis	Snow bramble
RUPE	Rubus pedatus	Five-leaved bramble, trailing b.
RUUR	Rubus ursinus	Pacific blackberry
RUAC	Rumex acetosella	Sheep sorrel
SEJA	Senecio jacobaea	Tansy ragwort
SESY	Senecio sylvaticus	Wood groundsel
SMRA	Smilacina racemosa	Large false solomon seal
SMST	Smilacina stellata	Small false solomon seal
STME2	Stachys maxicana	Mexicana, hedge-nettle
STCA2	Stellaria calycantha	Thick-leaved starwort
STAM	Streptopus amplexifolius	Clasping-leaved twisted-stalk
STRO	Streptopus roseus	Rosy twisted-stalk
TITR	Tiarella trifoliata	Theree-leaved foamflower
TIUN	Tiarella unifoliata	One-leaved foamflower
TOME	Tolmiea menziesii	Yount-on-age, Pig-a-back
TRLA2	Trientalis latifolia	Broad-leaved starflower
TROV	Trillium ovatum	White trillium, Wakerobin
TRCA	Trisetum canescens	Tall trisetum
TRCE	Trisetum cernuum	Nodding trisetum
TRSP	Trisetum spicatum	Spike trisetum
URDI	Urtica dioica	Stinging nettle
VASI	Valeriana sitchensis	Sitka valerian
VAHE	Vancouveria hexandra	Inside-out flower
VECH	Veronica chamaedrys	Speedwell
VIGL	Viola glabella	Pioneer violet
VISE	Viola sempervirens	Evergreen violet
XETE	Xerophyllum tenax	Common beargrass

TABLE XIII. COMMONLY OCCURRING PLANTS OF NON-FORESTED HABITATS, MT. BAKER-SNOQUALMIE NATIONAL FOREST

SHRUBS

TRI Code	Scientific Name	Common Name
ACCI	Acer circinatum	Vine maple
ALSI	Alnus sinuata	Sitka alder
AMAL	Amelanchier alnifolia	Serviceberry
ARUV	Arctostaphylos uva-ursi	Bearberry, Kinnikinnick
BENE	Berberis nervosa	Low Oregon grape
CAME	Cassiope mertensiana	White Mt. heather
CLPY	Cladothamnus pyroliflorus	Copper-bush
JUCO4	Juniperus communis	Common juniper
KAMI	Kalmia microphylla	Alpine laurel, small leaved laurel
KAOC	Kalmia occidentalis	Western Swamp laurel
MEFE	Menziesia ferruginea	Rusty menziesia, Fool's huckleberry
OPHO	Oplopanax horridum	Devil's club
PAMY	Pachystima myrsinites	Myrtle pachystima, Mt. lover
PHEM	Phyllodoce empetriformis	Red mountain heather
PREM	Prunus emarginata	Bitter cherry
RHAL	Rhododendron albiflorum	Cascades azalea, white rhododendron
RIBR	Ribes bracteosum	Stinking black currant
RIHO	Ribes howellii	Mapleleaf currant
RILA	Ribes lacustre	Prickly currant
ROGY	Rosa gymnocarpa	Baldhip rose
RUPA	Rubus parviflorus	Western thimbleberry
RUSP	Rubus spectabilis	Salmonberry
SARA	Sambucus racemosa	Red elderberry
SOSI	Sorbus sitchensis	Sitka mountain ash
SPDE	Spiraea densiflora	Subalpine spiraea
SPDO	Spiraea douglasii	Douglas spiraea
VAAL	Vaccinium alaskaense	Alaska huckleberry
VACA	Vaccinium caespitosum	Dwarf huckleberry
VADE	Vaccinium deliciosum	Blue-leaf huckleberry
VAME	Vaccinium membranaceum	Thin-leaved huckleberry
VAOV	Vaccinium ovalifolium	Oval-leaf huckleberry
VASC	Vaccinium scoparium	Grouse whortleberry

HERBS

ACMI	Achillea millefolium	Western yarrow
ACTR	Achlys triphylla	Vanillaleaf
AGAU	Agoseris aurantiaca	Orange agoseris or false dandelion
AGEX	Agrostis exarata	Spike bentgrass
AGID	Agrostis idahoensis	Idaho bentgrass
AGHU	Agrostis humilis	Alpine bentgrass
AGOR	Agrostis oregonensis	Oregon bentgrass
AGSC	Agrostis scabra	Winter bentgrass, rough hairgrass
ANAR2	Angelica arguta	Lyall's or sharptooth angelica
ANCA	Angelica canbyi	Candy's angelica

TRI Code	Scientific Name	Common Name
ANGE	Angelica genuflexa	Kneeling angelica
ANMA	Anaphalis margaritacea	Common pearly-everlasting
ANOC	Anemone occidentalis	Western pasque flower
ANMI2	Antennaria microphylla	Rosy pussy-toes
AQFO	Aquilegia formosa	Red columbine
ARLA	Arnica latifolia	Broadleaf arnica
ARTR3	Artemisia trifurcata	Three forked artemisia
ARSY	Aruncus sylvester	Sylan goatsbeard
ASCA3	Asarum caudatum	Wild ginger
ASLE2	Aster ledophyllus	Cascade aster
ATFI	Athyrium filix-femina	Lady fern
BLSP	Blechnum spicant	Deer fern
BOEL	Boykinia elata	Slender boykinia
BRVU	Bromus vulgaris	Common brome
CACA	Calamagrostis canadensis	Bluejoint reedgrass
CABI	Caltha biflora	White marshmarigold
CARO3	Campanula rotundifolia	Scotch bellflower, lady's thimble
CAAQ	Carex aquatilis	Water sedge
CADE	Carex deweyana	Dewey's sedge
CAGE	Carex geyeri	Elk sedge
CAIN5	Carex interior	Inland sedge
CALE5	Carex lenticularis	Lenticular sedge
CAME2	Carex mertensii	Merten's sedge
CAMI2	Carex nigricans	Black alpine sedge
CAPH	Carex phaeocephala	Dunhead sedge
CARO	Carex rossii	Ross' sedge
CASA2	Carex saxatilis	Russet sedge
CASP	Carex spectabilis	Showy sedge
CAVE	Carex vesicaria	Inflated sedge
CAMI2	Castilleja miniata	Scarlet paintbrush
CAPA3	Castilleja parviflora	Magenta paintbrush
CIAL	Circaea alpina	Enchanter's nightshade
CIED	Cirsium edule	Edible thistle
CLLA	Claytonia lanceolata	Western spring beauty
CLUN	Clintonia uniflora	Queen's cup, bead lily
COCA	Cornus canadensis	Bunchberry
COSC	Corydalis scouleri	Scouler's corydalis
CRCR	Cryptogramma crispa	Parsley fern
DAIN	Danthonia intermedia	Timber danthonia or oatgrass
DEGL2	Delphinium glareosum	Rockslide larkspur
DEAT	Deschampsia atropurpurea	Montain harigrass
DIFO	Dicentra formosa	Pacific bleedingheart
DIHO	Digitalis purpurea	Foxglove
DIPU	Disporum hookeri	Hooker's fairbell
DISM	Disporum smithii	Smith fairybell
DOJE	Dodecatheon jeffreyi	Jeffrey's shooting star
DRRO	Drosera rotundifolia	Sundew
DRAU2	Dryopteris austriaca	Spreading woodfern
ELPA	Eleocharis palustris	Common or creeping spike-rush
ELGL	Elymus glaucus	Blue wildrye
EPAL	Epilobium alpinum	Alpine willow-herb
EPAN	Epilobium angustifolium	Fireweed
EPGL	Epilobium glaberrimum	Common willow-herb

TRI Code	Scientific Name	Common Name
EQAR	Equisetum arvenge	Common horsetail
ERPE	Erigeron peregrinus	Subalpine daisy
ERPO2	Eriophorum polystachion	Many spiked cotton-grass
ERMO	Erythronium montanum	Avalanche fawn-lily
FEVI	Festuca viridula	Green fescue
FRVI	Fragaria virginiana	Broadpetal strawberry
GAAP	Galium aparine	Catchweed bedstraw
GATR	Galium triflorum	Fragrant bedstraw
GECA	Gentiana calycosa	Explorer gentian, Mt. bog gentian
GLEL	Glyceria elata	Tall mannagrass
GYDR	Gymnocarpium dryopteris	Oak fern
HADI2	Habenaria dilatata	White bog orchid
HASA	Habenaria saccata	Slendar bog-orchid
HELA	Heracleum lanatum	Cow parsnip
HIAL	Hieracium albiflorum	White flowered hawkweed
HIGR	Hieracium gracile	Western hawkweed
HYFE	Hydrophyllum fendleri	Pacific waterleaf
HYTE	Hydrophyllum tenuipes	Slender-stemmed waterleaf
HYAN	Hypericum anagalloides	Trailing St. Johnswort
JUDR	Juncus drummondii	Drummond rush
JUEF	Juncus effusus	Common rush
JUEN	Juncus ensifolius	Swordleaf rush
JUKE	Juncus kelloggii	Kellogg's rush
JUME	Juncus mertensianus	Merten's rush
JUPA	Juncus parryi	Parry rush
LEPY2	Leptarrhena pyrolifolia	False saxifrage
LICA2	Ligusticum canbyi	Canby licoriceroot or lovage
LIGR	Ligusticum grayii	Gray's licoriceroot or lovage
LICO4	Lilium columbianum	Columbia lily
LOMA2	Lomatium martindalei	Martindale's lomatium
LUPE	Luetkea pectinata	Partridge foot
LUST	Luina stricta	Tongue-leaf luina
LULA	Lupinus latifolius	Broadleaf lupine
LUCA2	Luzula campestris	Field woodrush
LUPA	Luzula parviflora	Millet woodrush
LYAM	Lysichitum americanum	Skunk cabbage
MADI	Maianthenum dilatatum	Beadruby
METR	Menyanthes trifoliata	Common bogbean
MEPA	Mertensia paniculata	Panicle bluebells
MIBR	Mitella breweri	Brewer's mitrewort
MIOV	Mitella ovalis	Oval-leaved mitrewort
MOSI	Montia sibirica	Candyflower
NONE	Nothochelone nemorosa	Woodland beardtongue
NUPO	Nuphar polysepala	Yellow waterlily
OESA	Oenanthe sarmentosa	Pacific waterdropwort
OSCH	Osmorhiza chilensis	Mountain sweet-cicely
PEBR	Pedicularis bracteosa	Bracted lousewort
PECO2	Pedicularis contorta	White coiled-beak lousewort
PEGR	Pedicularis groenlandica	Pink elephants, elephant's head
PEOR5	Pedicularis ornithorhynca	Bird's-beak pedicularis
PEDA	Penstemon davidsonii	Davidson's penstemon
PHAL	Phleum alpinum	Alpine timothy

TRI Code	Scientific Name	Common Name
PHPR	Phleum pratense	Timothy
PHDI	Phlox diffusa	Spreading phlox
PIVU	Pinguicula vulgaris	Common butterwort
POPU	Polemonium pulcherrimum	Skunkleaf polemonium or Jacob's Ladder
POBI	Polygonum bistortoides	American bistort
POFL2	Potentilla flabellifolia	Fanleaf cinquefoil
PONA2	Potomogeton nataus	Flouting leaved pondweed
PTAQ	Pteridium aquilinum	Braken fern
PUPA	Paccinellia pauciflora	Weak alkaligrass
RAAL	Ranunculus alismaefolias	Plantainleaf buttercup
RAES	Ranunculus eschscholtzii	Subalpine buttercup
RULA	Rubus lasiococcus	Dwarf bramble, Trailing bramble
RUPE	Rubus pedatus	Five-leaved bramble, Trailing bramble
RUUR	Rubus ursinus	Pacific blackberry
RUAC	Rumex acetocella	Sheep sorrel, Sour weed
RUOB	Rumex obtusifolius	Bitter dock, Broadleaved dock
SASI	Sanguisorba sitkensis	Sitka burnet
SAAM	Saussurea americana	American sawwort
SAFE	Saxifraga ferruginea	Rusty saxifrage
SAPU	Saxifraga punctata	Dotted saxifrage
SCMI	Scirpus microcarpus	Small fruited bullrush, panicled bullrush
SEDI	Sedum divergens	Spreading stonecrop
SETR	Senecio triangularis	Arrowleaf groundsel
SIPA	Silene parryi	Parry's silene
SMRA	Smilacina racemosa	Western solomon-plume, large false solomon seal
SMST	Smilacina stellata	Starry solomon-plume, small false solomon seal
SPAN	Sparganium angustifolium	Narrowleaf burreed
STME2	Stachys mexicana	Mexicana betony or hedge nettle
STCR	Stellaria crispa	Crisped starwort
STAM	Streptopus amplexifolius	Clasping-leaved twisted stalk
STRO	Streptopus roseus	Rosy twisted-stalk
TAOF	Taraxacum officianale	Common dandelion
TITR	Tiarella trifoliata	Three-leaved foamflower
TIUN	Tiarella unifoliata	One-leaved foamflower
TOGL	Tofieldia glutinosa	Sticky tofieldia
TOME	Tolmiea menziesii	Youth-on-age, Pig-a-back
TRLA2	Trientalis latifolia	Broad-leaved starflower
TRRE	Trifolium repens	Dutch clover
TROV	Trillium ovatum	White trillium, Wakerobin
TRCE	Trisetum cernuum	Nodding trisetum
TRSP	Tristetum spicatum	Spike trisetum
URDI	Urtica dioica	Nettle
VASI	Valeriana sitchensis	Sitka valerian
VEVI	Veratrum viride	Green false hellebore
VEAN	Veronica anagallis-aquatica	Water speedwell
VECU	Veronica cusickii	Cusick's speedwell
VEWO	Veronica wormskjoldii	American alpine speedwell
VIGL	Viola glabella	Pioneer violet
VISE	Viola sempervirens	Evergreen violet
XETE	Xerophyllum tenax	Common beargrass

Trees

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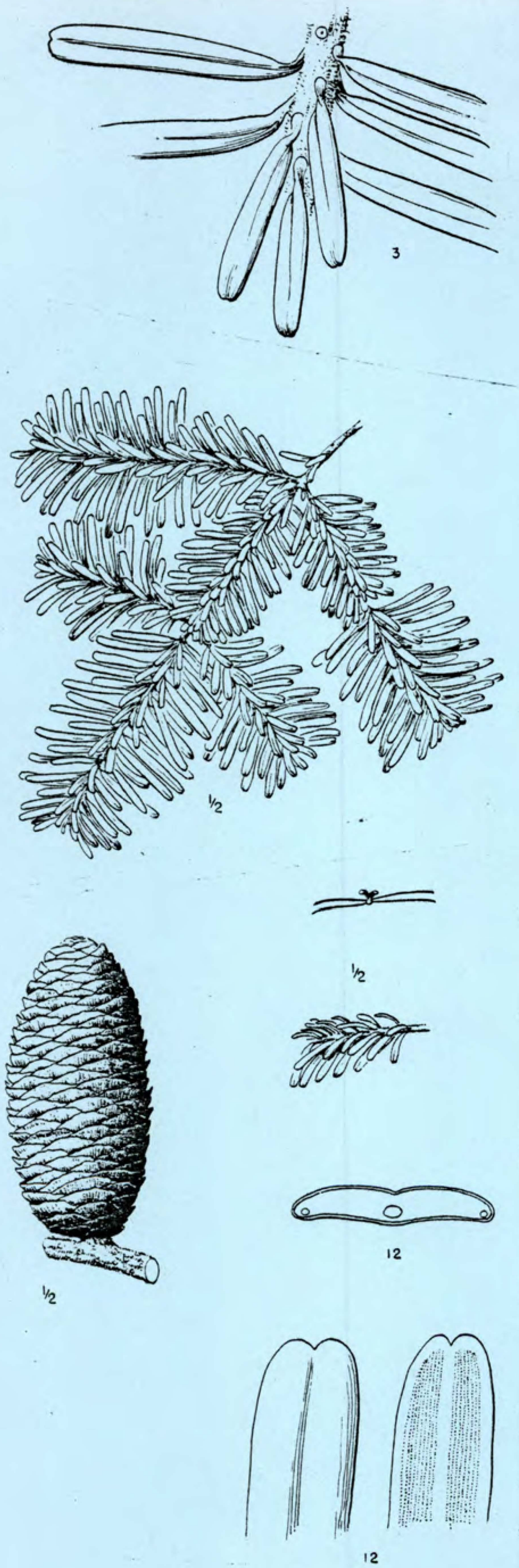
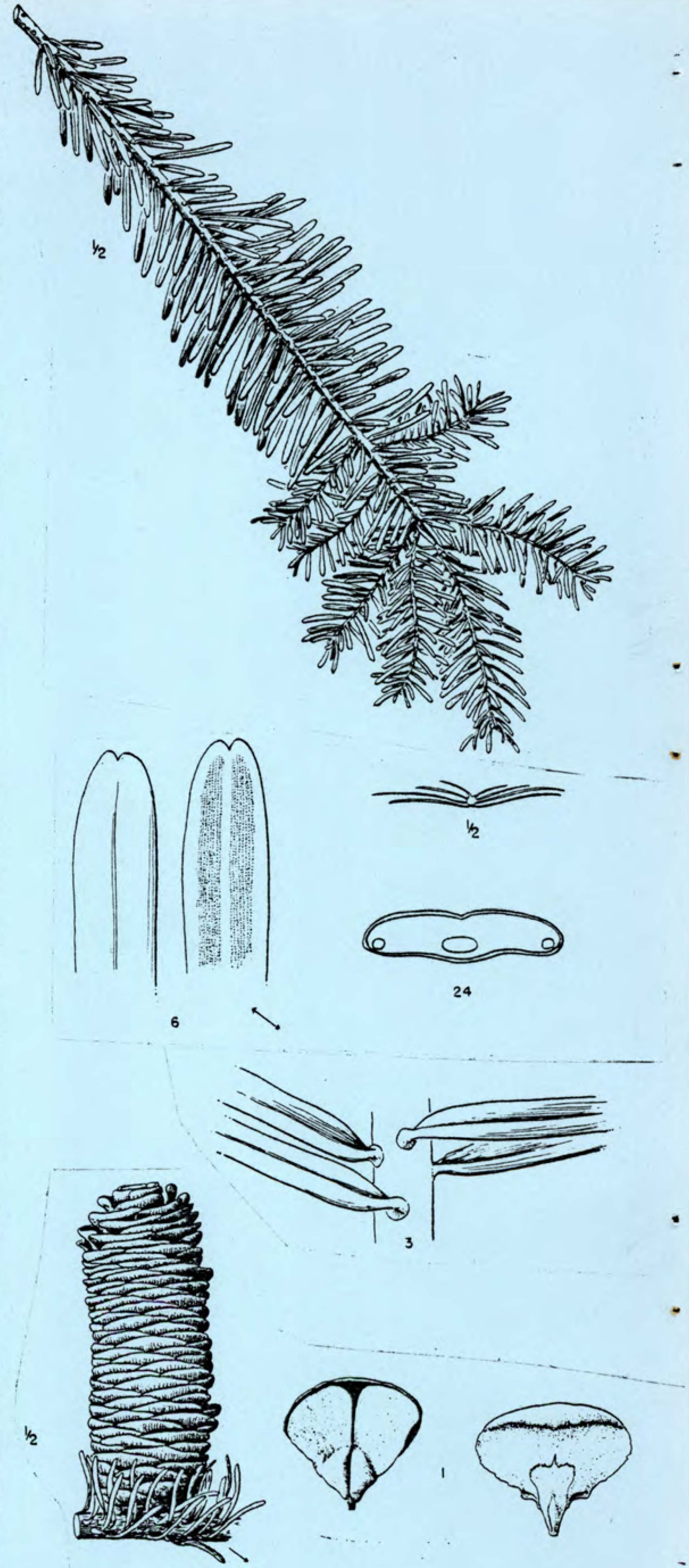


PACIFIC SILVER FIR

Abies amabilis

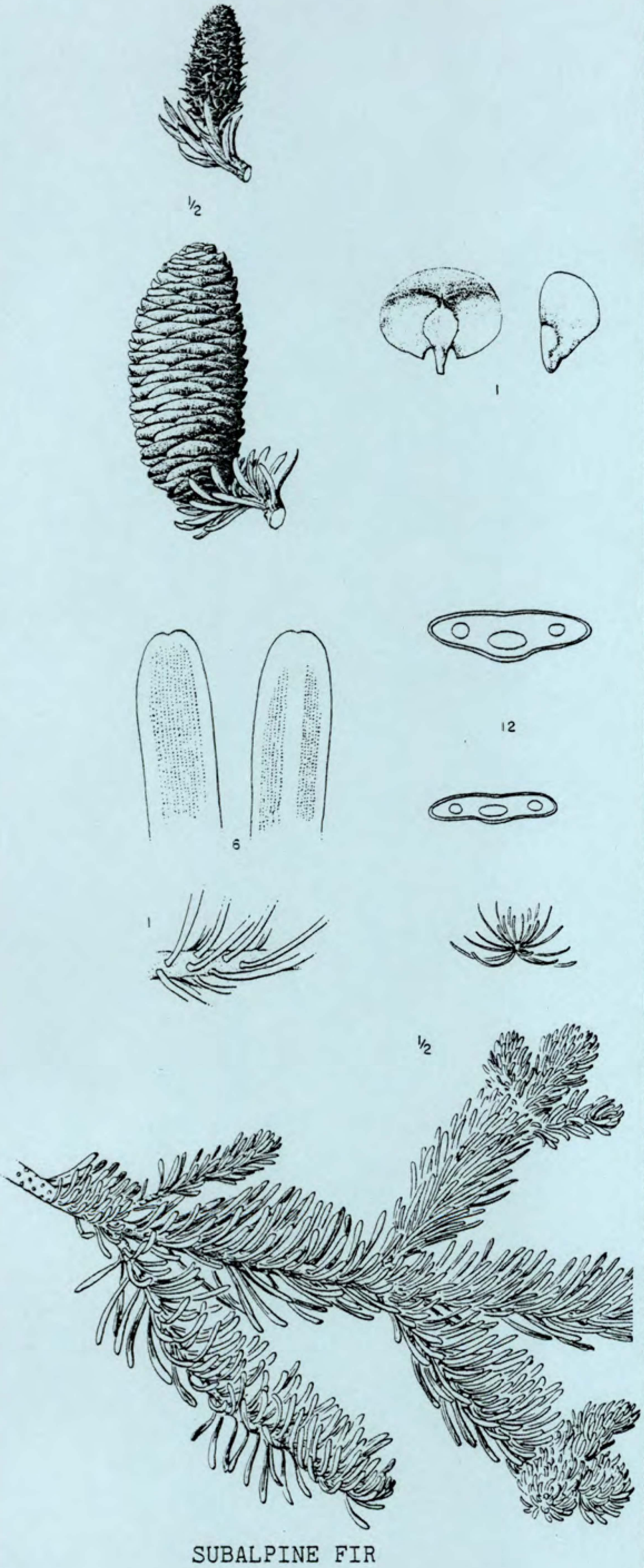
(Abam)



GRAND FIR

Abies grandis

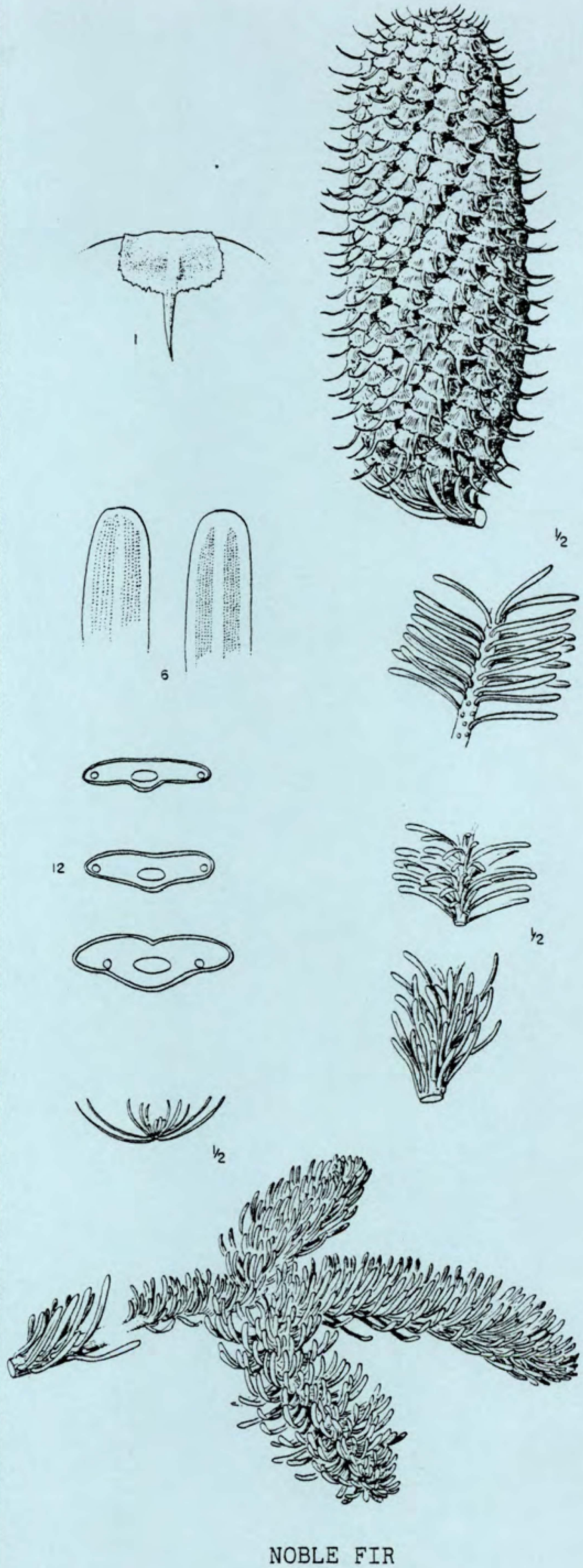
(Abgr)



SUBALPINE FIR

<u>Abies</u> <u>lasiocarpa</u>

(Abla2)



NOBLE FIR

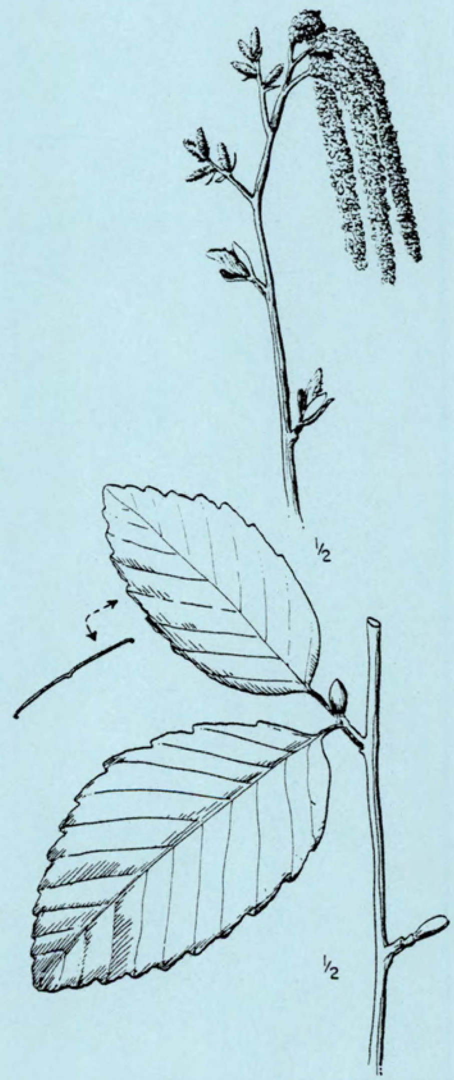
<u>Abies</u> <u>procera</u>

(Abpr)

BIGLEAF MAPLE

Acer macrophyllum

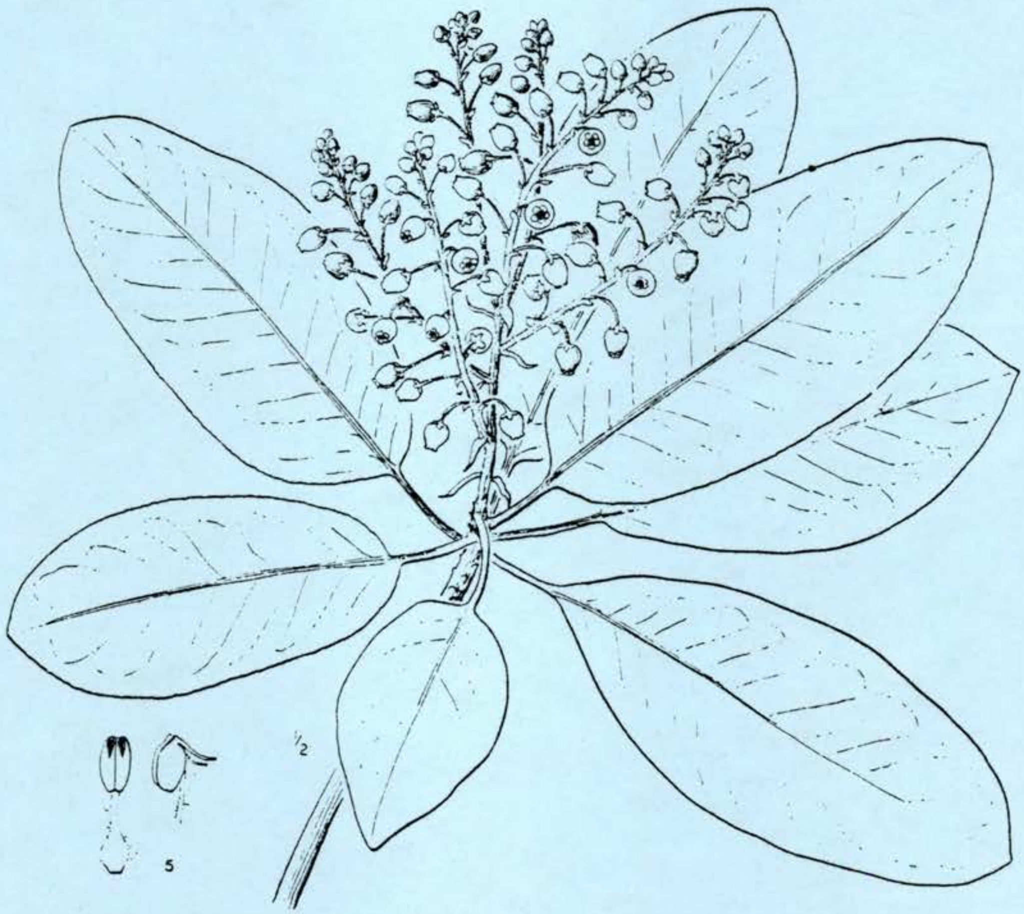
(Acma)



RED ALDER

Alnus rubra

(Alru)



PACIFIC MADRONE

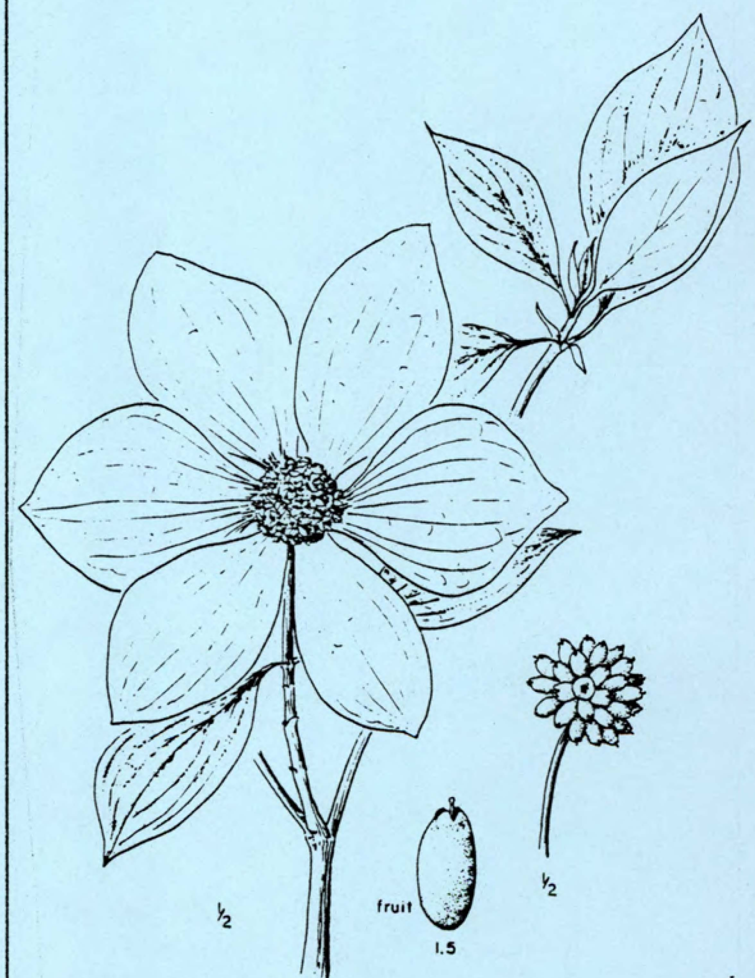
Arbutus menziesii

(Arme)

ALASKA YELLOWCEDAR

<u>Chamaecyparis</u> <u>nootkatensis</u>

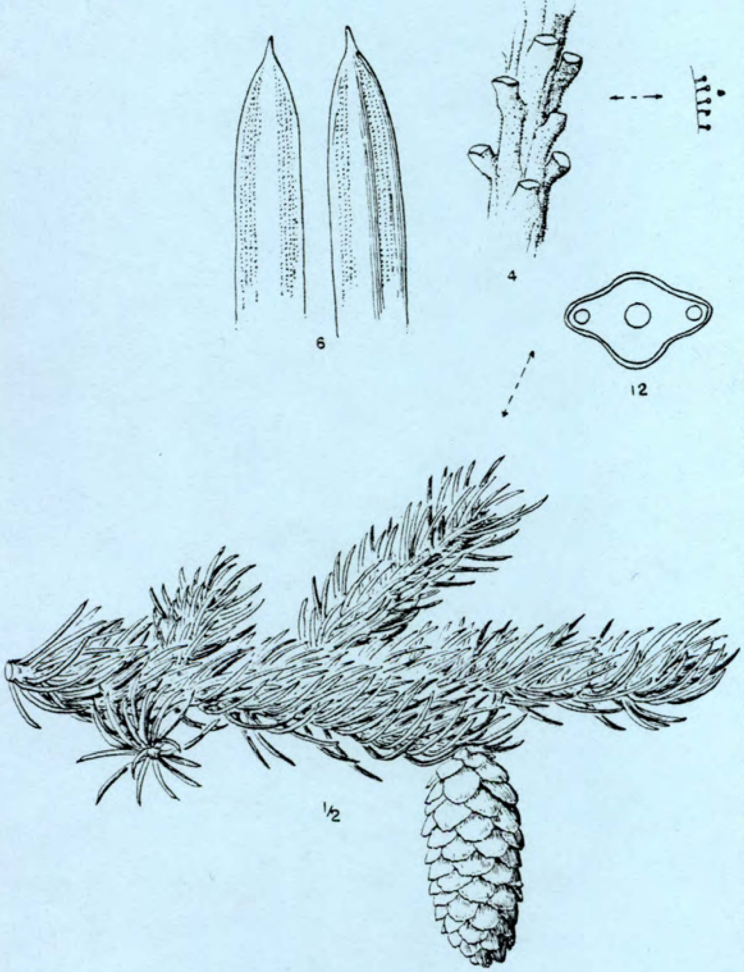
(Chno)



PACIFIC DOGWOOD

<u>Cornus</u> <u>nuttallii</u>

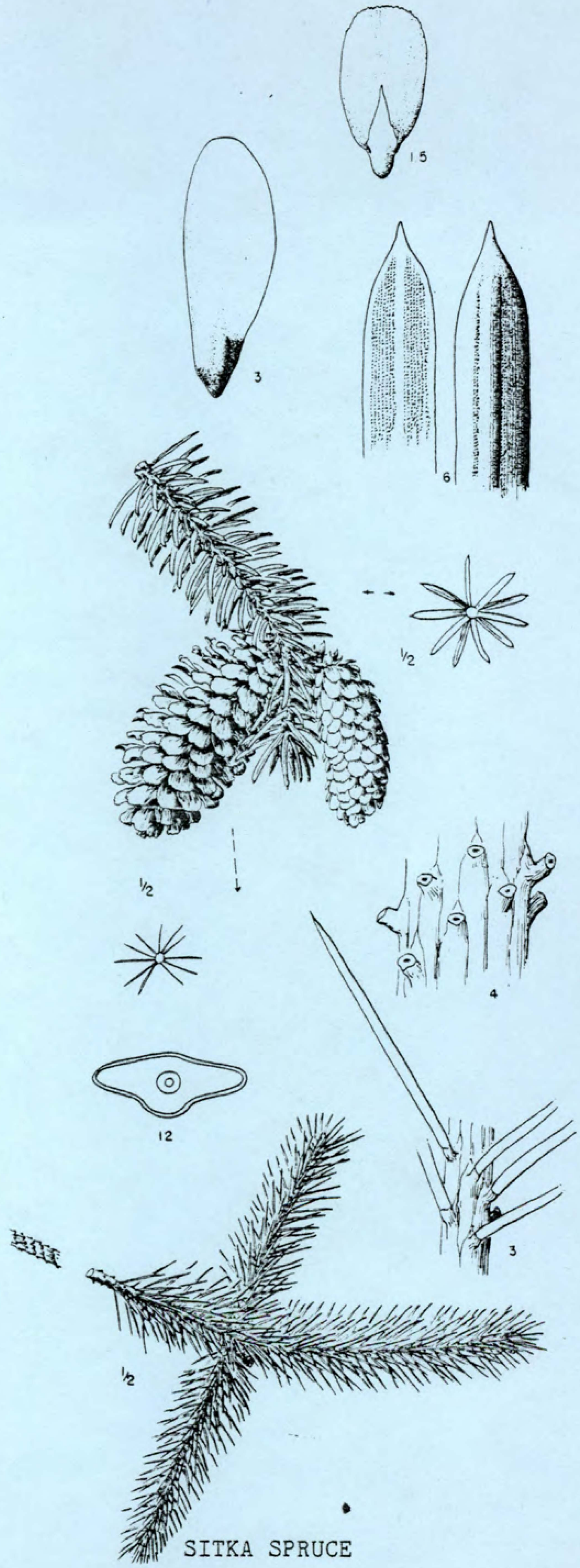
(Conu)



ENGLEMANN SPRUCE

<u>Picea</u> <u>engelmannii</u>

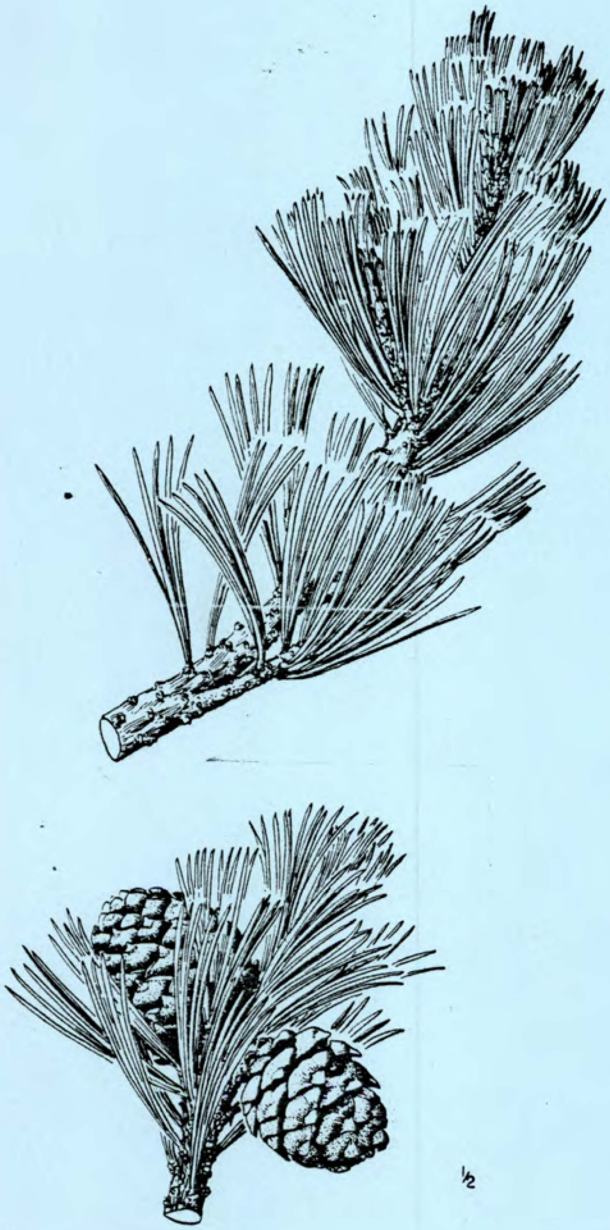
(Pien)



SITKA SPRUCE

<u>Picea</u> <u>sitchensis</u>

(Pisi)



WHITEBARK PINE

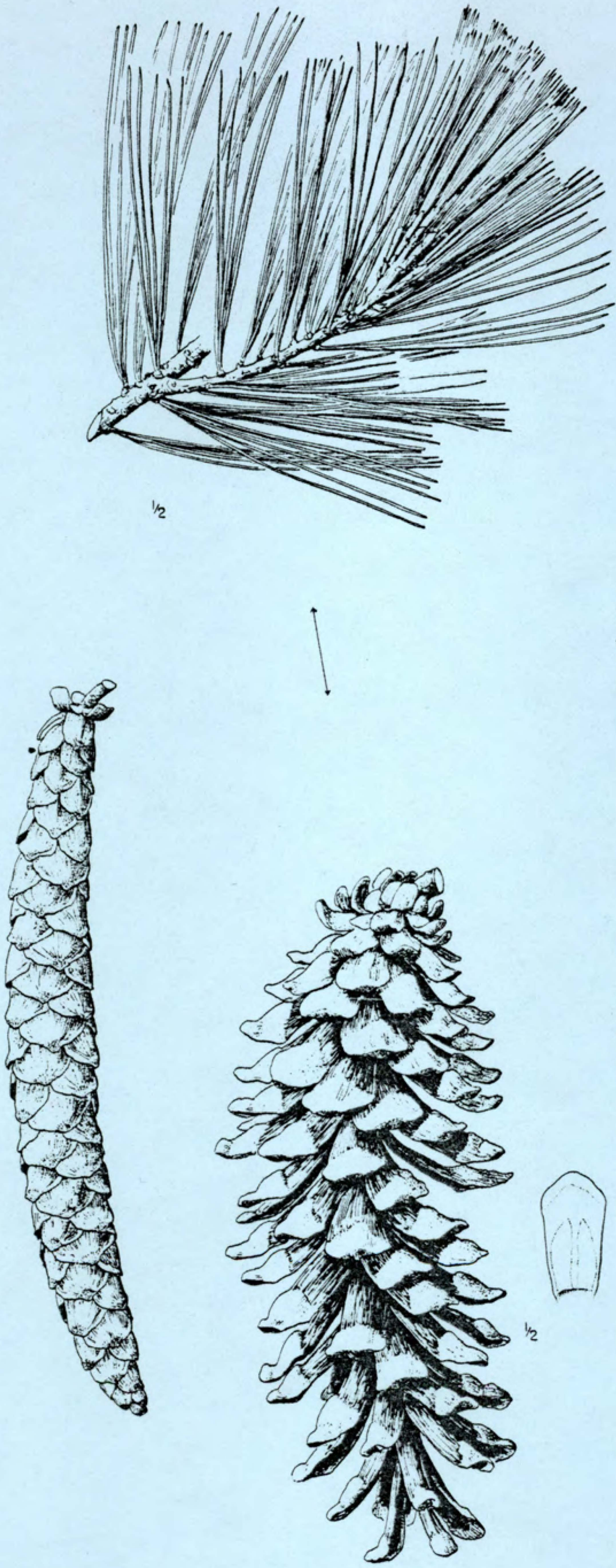
Pinus albicaulis

(Pial)

LODGEPOLE PINE

Pinus contorta

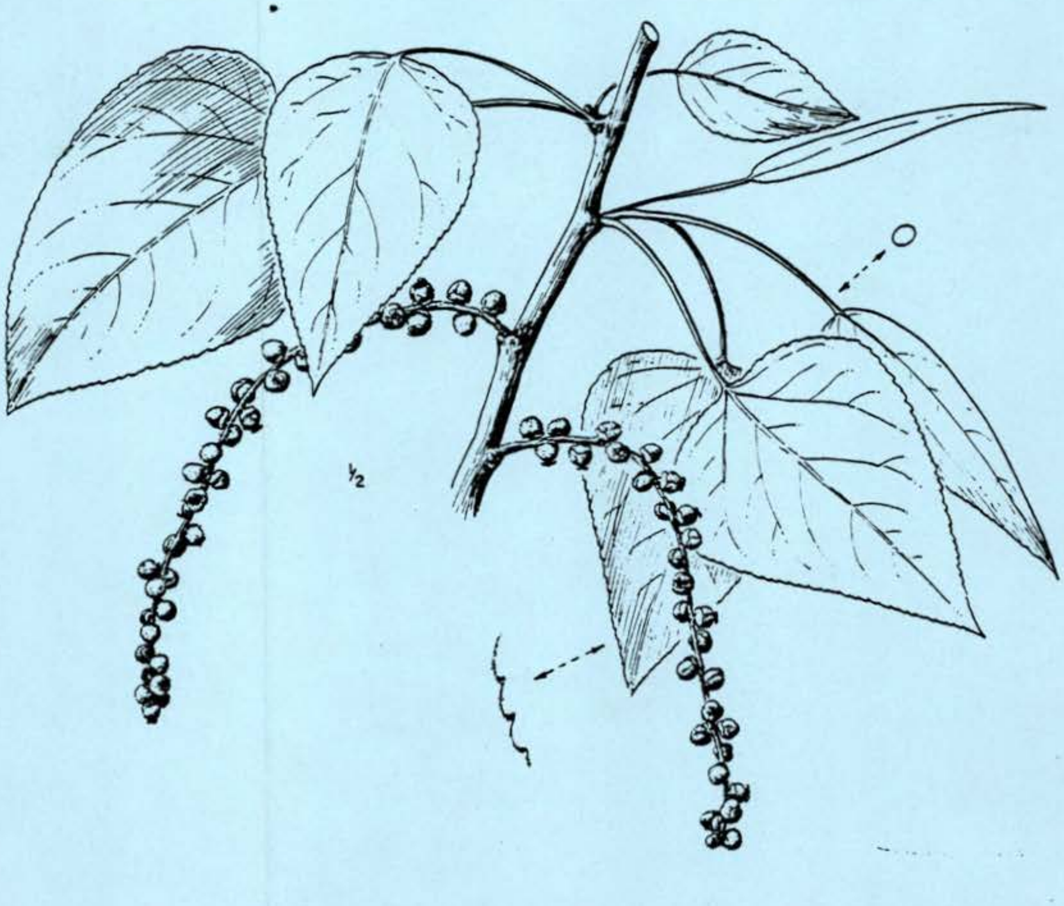
(Pico)



WESTERN WHITE PINE

Pinus monticola

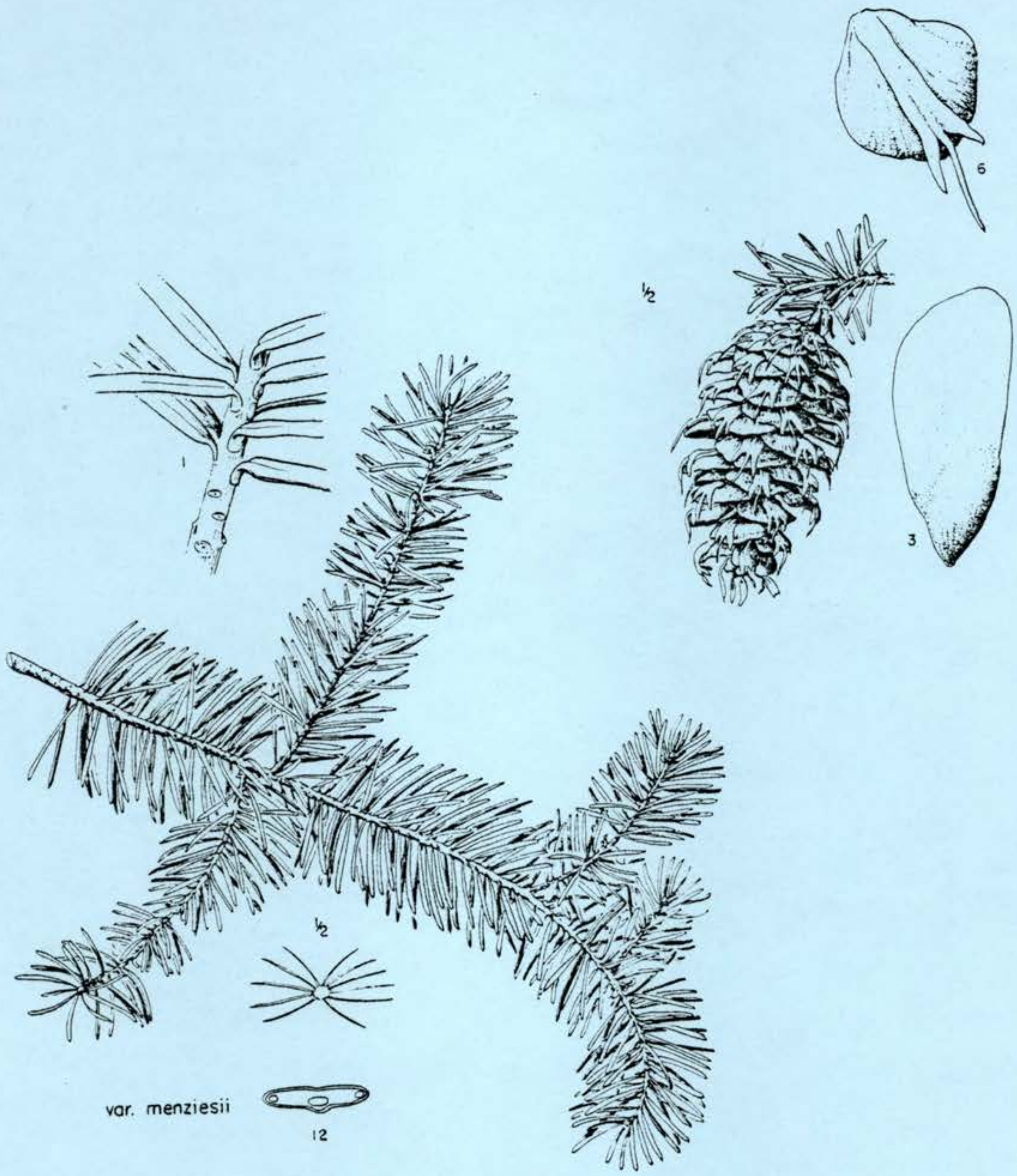
(Pimo)



BLACK COTTONWOOD

Populus trichocarpa

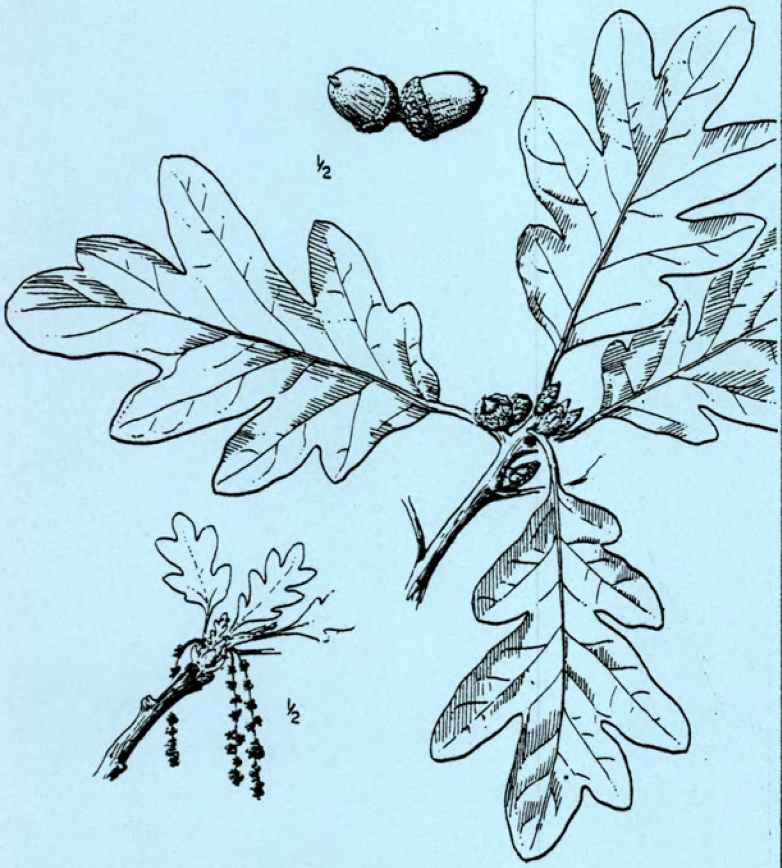
(Potr2)



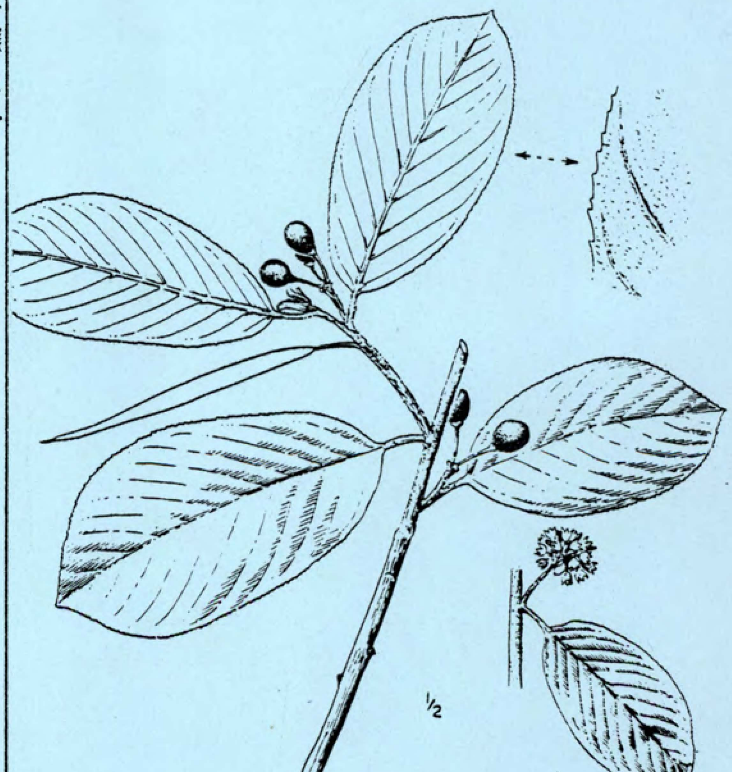
DOUGLAS-FIR

Pseudotsuga menziesii menziesii

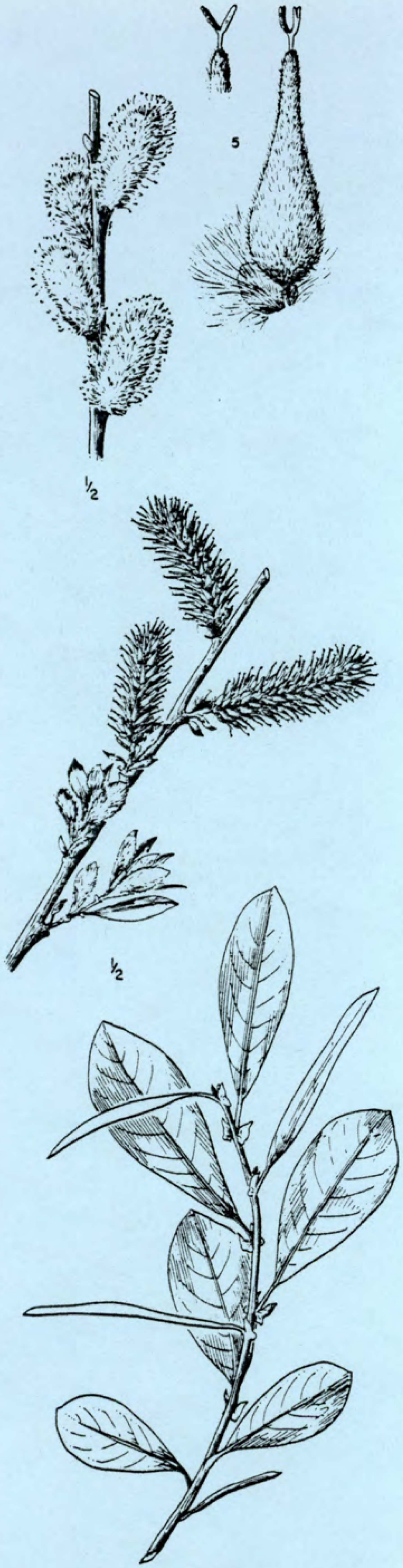
(Psmem)



GARRY OAK
Quercus garryana
(Quga)



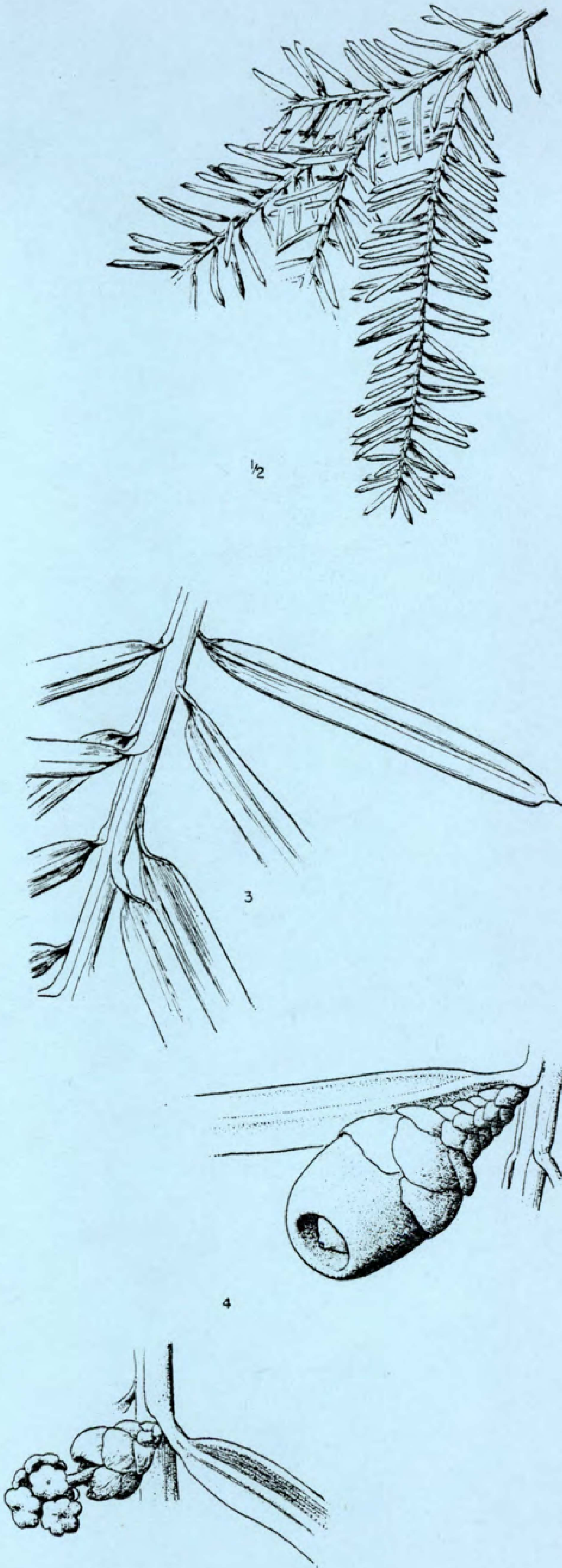
CASCARA BUCKTHORN
Rhamnus purshiana
(Rhpu)



SCOULER WILLOW

Salix scouleriana

(Sasc)



PACIFIC YEW

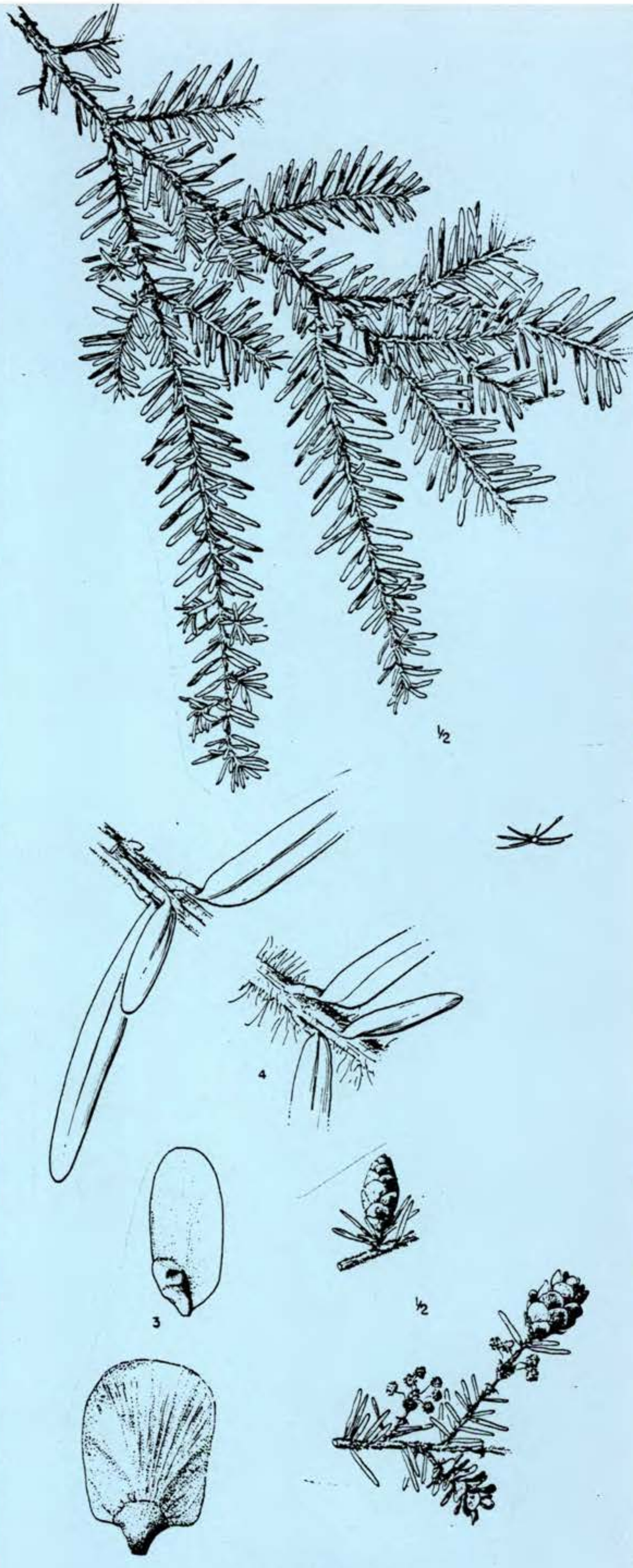
Taxus brevifolia

(Tabr)

WESTERN REDCEDAR

<u>Thuja</u> <u>plicata</u>

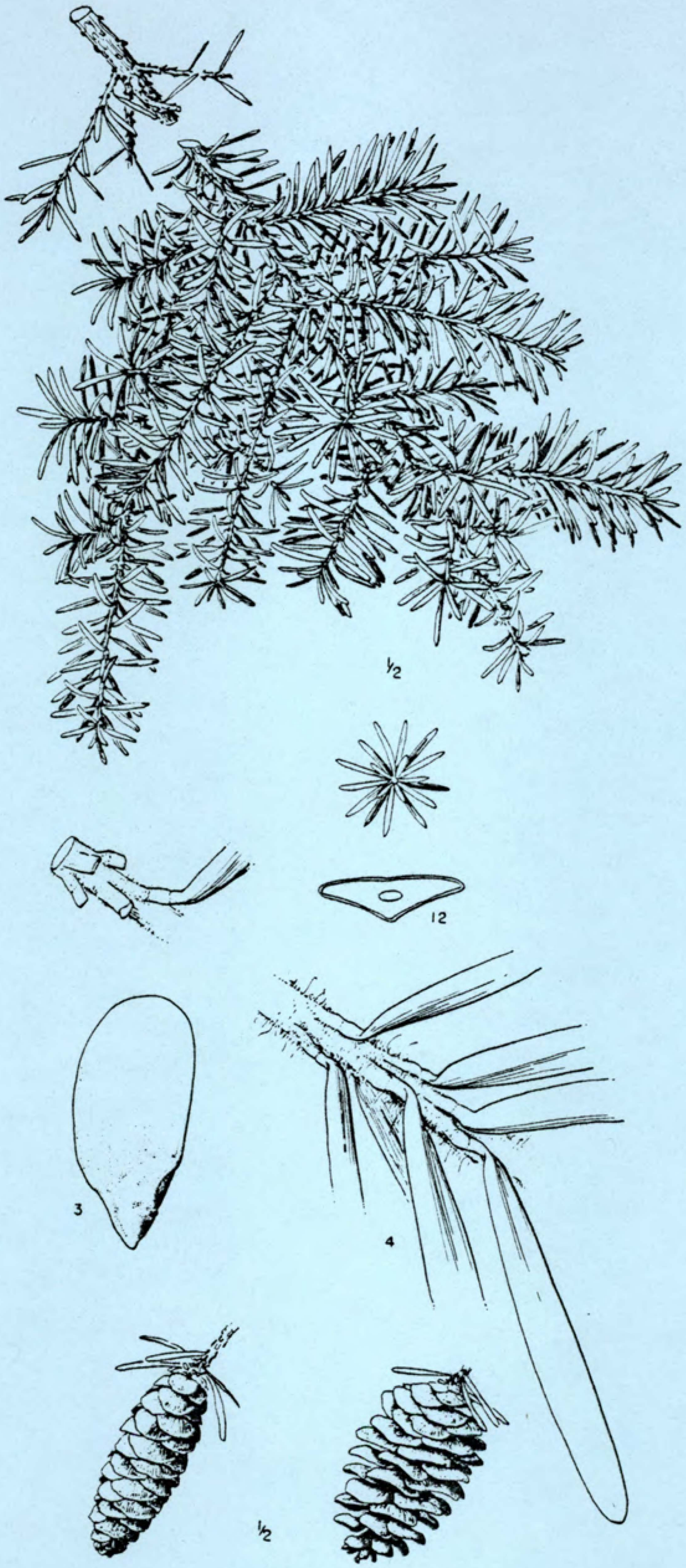
(Thpl)



WESTERN HEMLOCK

<u>Tsuga</u> <u>heterophylla</u>

(Tshe)



MOUNTAIN HEMLOCK

Tsuga mertensiana

(Tsme)

Shrubs

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VINE MAPLE

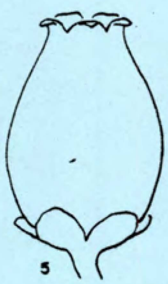
Acer circinatum

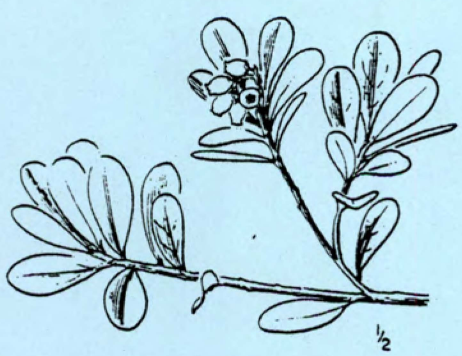
(Acci)

SITKA ALDER

Alnus sinuata

(Alsi)

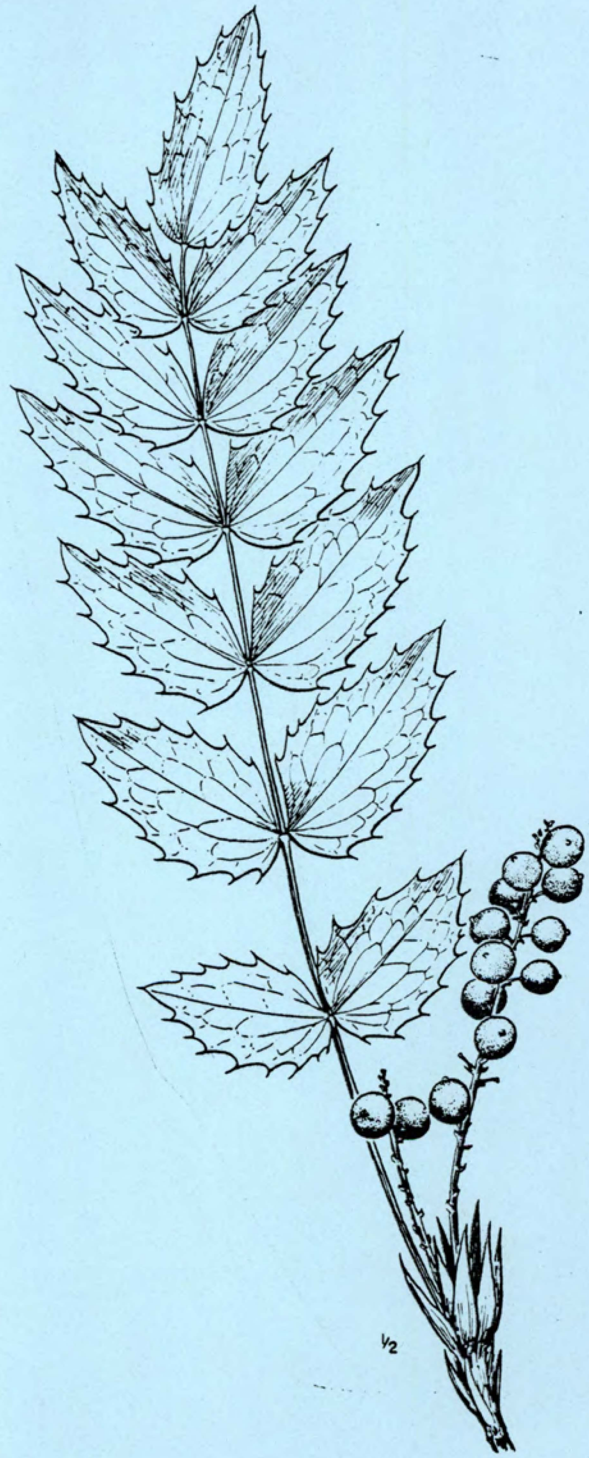




BEARBERRY, KINNIKINNICK

Arctostaphylos uva-ursi

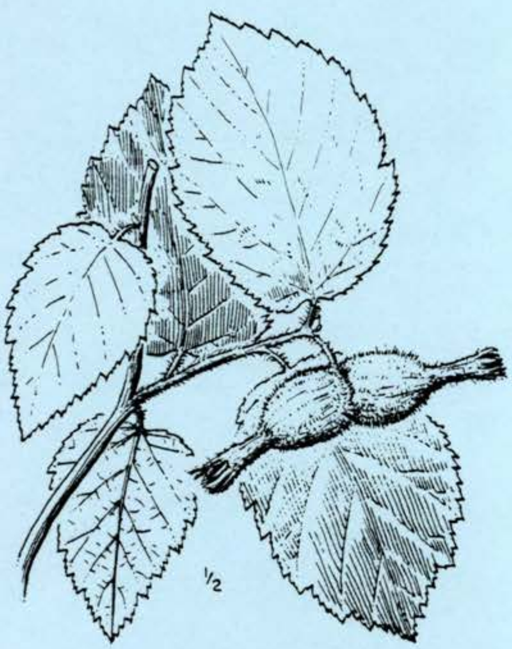
(Aruv)



LOW OREGONGRAPE

Berberis nervosa

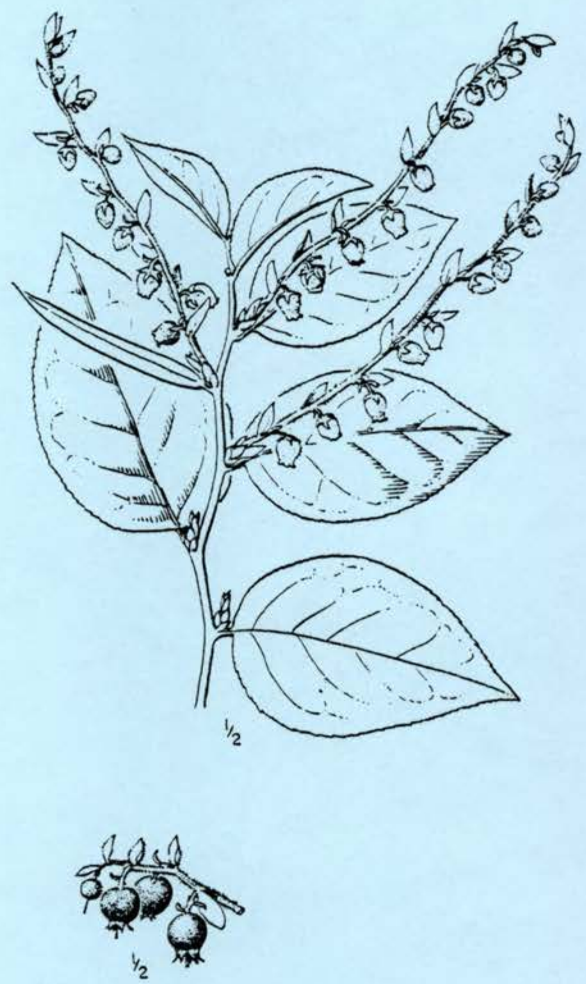
(Bene)



CALIFORNIA HAZELNUT

Corylus cornuta californica

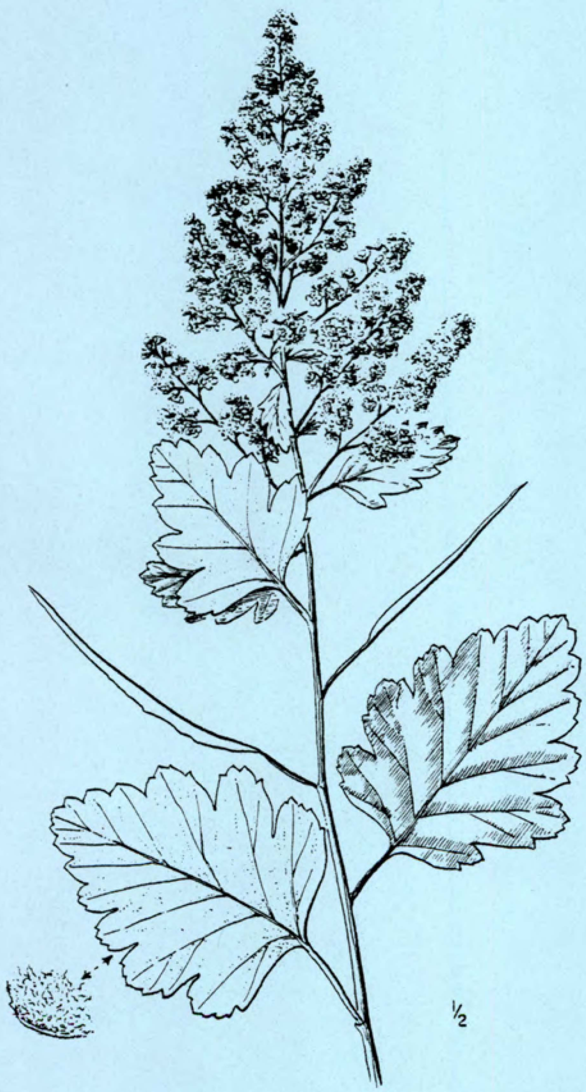
(Cococ)



SALAL

Gaultheria shallon

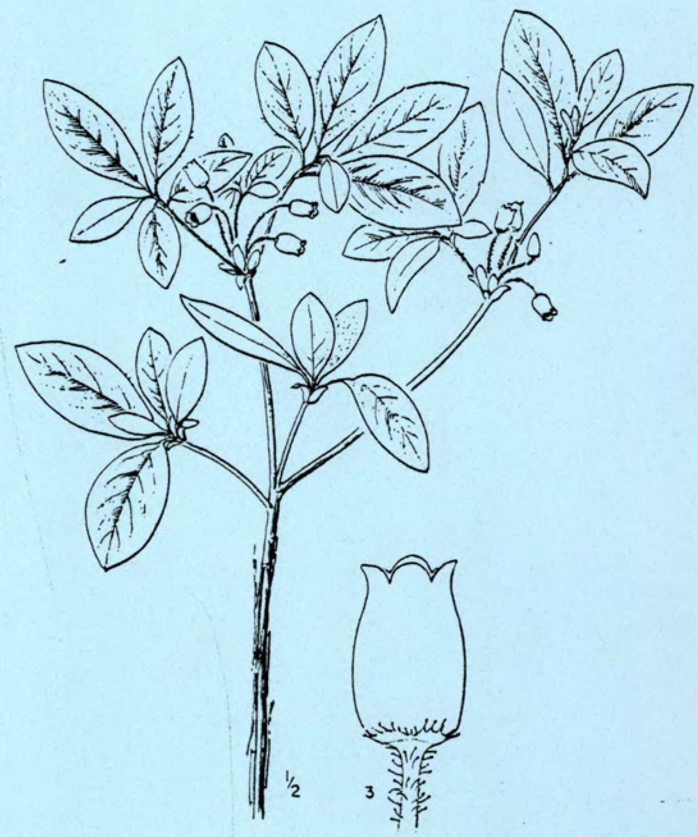
(Gash)



OCEANSPRAY

Holodiscus discolor

(Hodi)



RUSTY MENZIESIA, FOOL'S HUCKLEBERRY

Menziesia ferruginea

(Mefe)

DEVIL'S CLUB

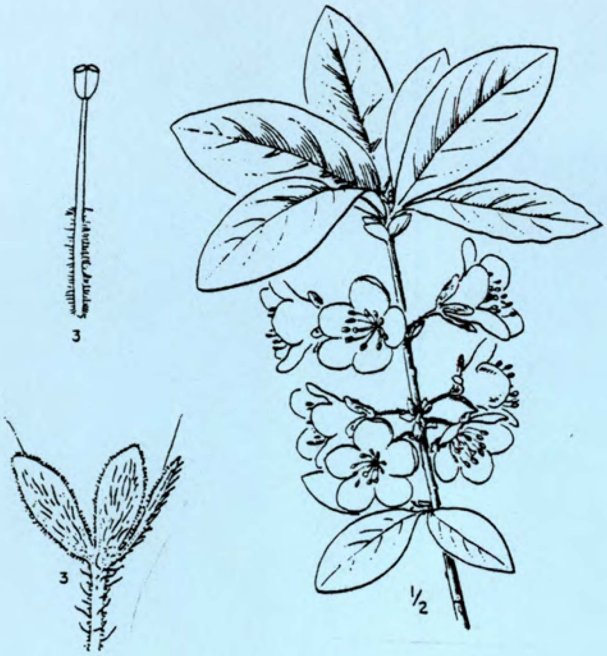
Oplopanax horridum

(Opho)

MYRTLE PACHYSTIMA, MT. LOVER

Pachistima myrsinites

(Pamy)



CASCADES AZALEA, WHITE RHODODENDRON

Rhododendron albiflorum

(Rhal)

PACIFIC RHODODENDRON

Rhododendron macrophyllum

(Rhma)

STINK CURRANT

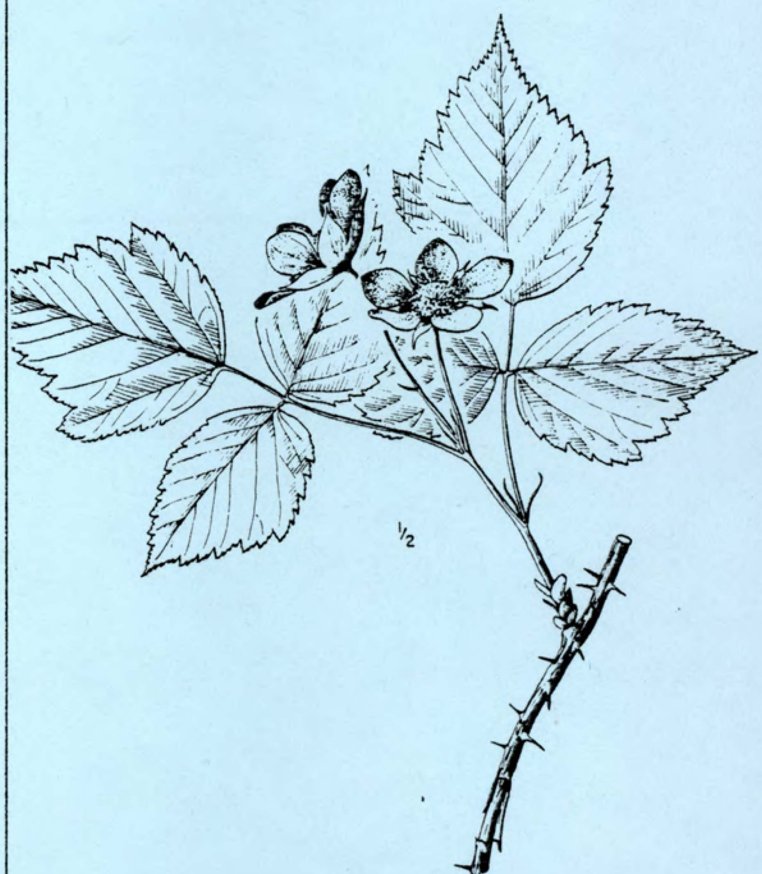
Ribes bracteosum

(Ribr)

WESTERN THIMBLEBERRY

<u>Rubus</u> <u>parviflorus</u>

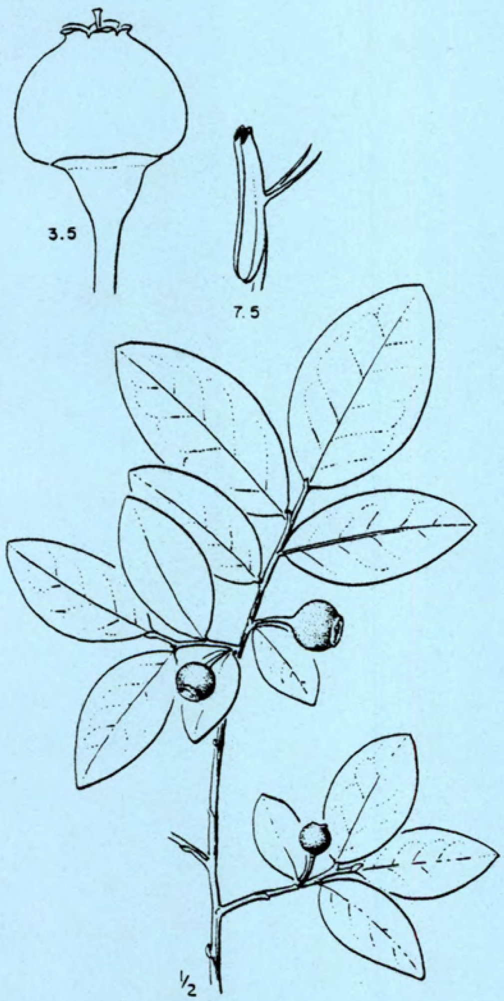
(Rupa)



SALMONBERRY

<u>Rubus</u> <u>spectabilis</u>

(Rusp)



ALASKA HUCKLEBERRY

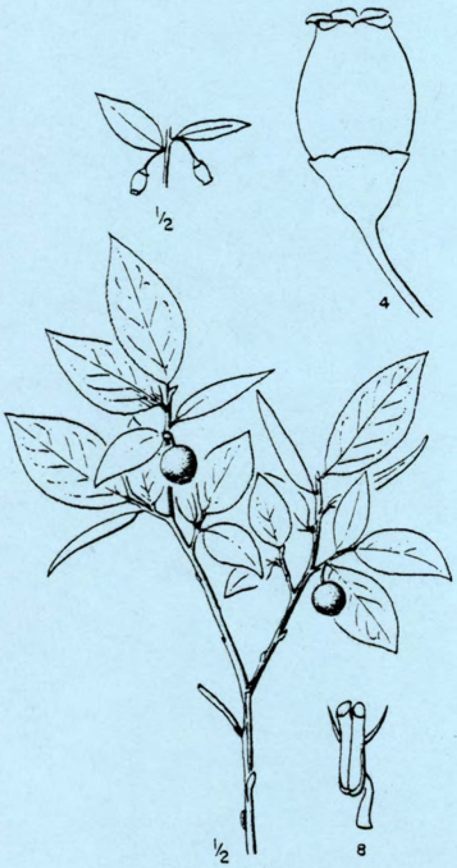
Vaccinium alaskaense

(Vaal)

BLUE-LEAF HUCKLEBERRY

Vaccinium deliciosum

(Vade)



THIN-LEAVED HUCKLEBERRY

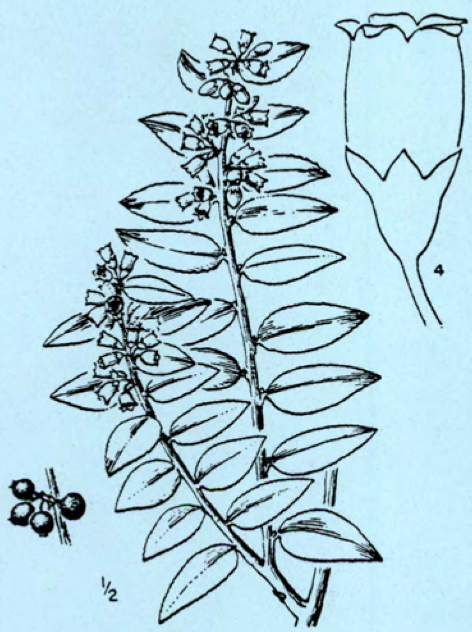
Vaccinium membranaceum

(Vame)

OVAL-LEAF HUCKLEBERRY

Vaccinium ovalifolium

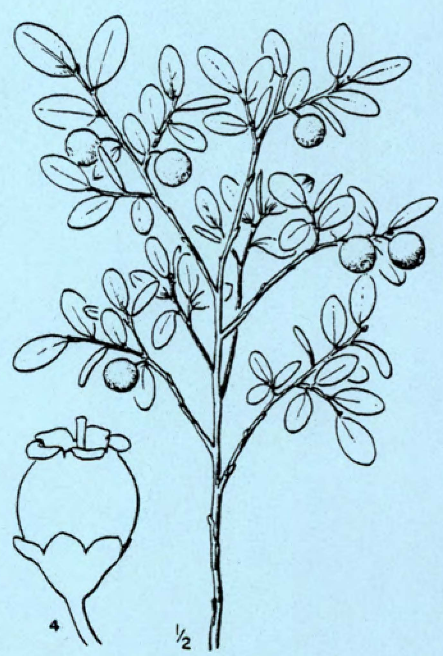
(Vaov)



EVERGREEN HUCKLEBERRY

Vaccinium ovatum

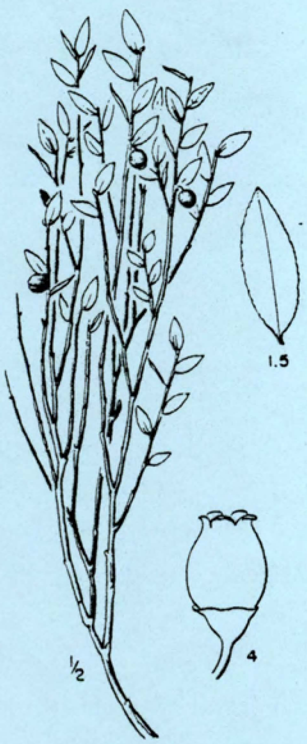
(Vaov2)



RED HUCKLEBERRY

Vaccinium parvifolium

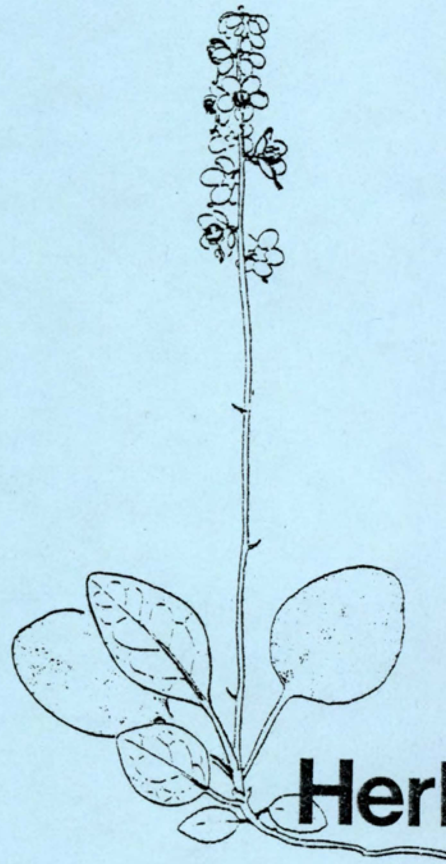
(Vapa)



GROUSE WHORTLEBERRY

<u>Vaccinium</u> <u>scoparium</u>

(Vasc)



Herbs

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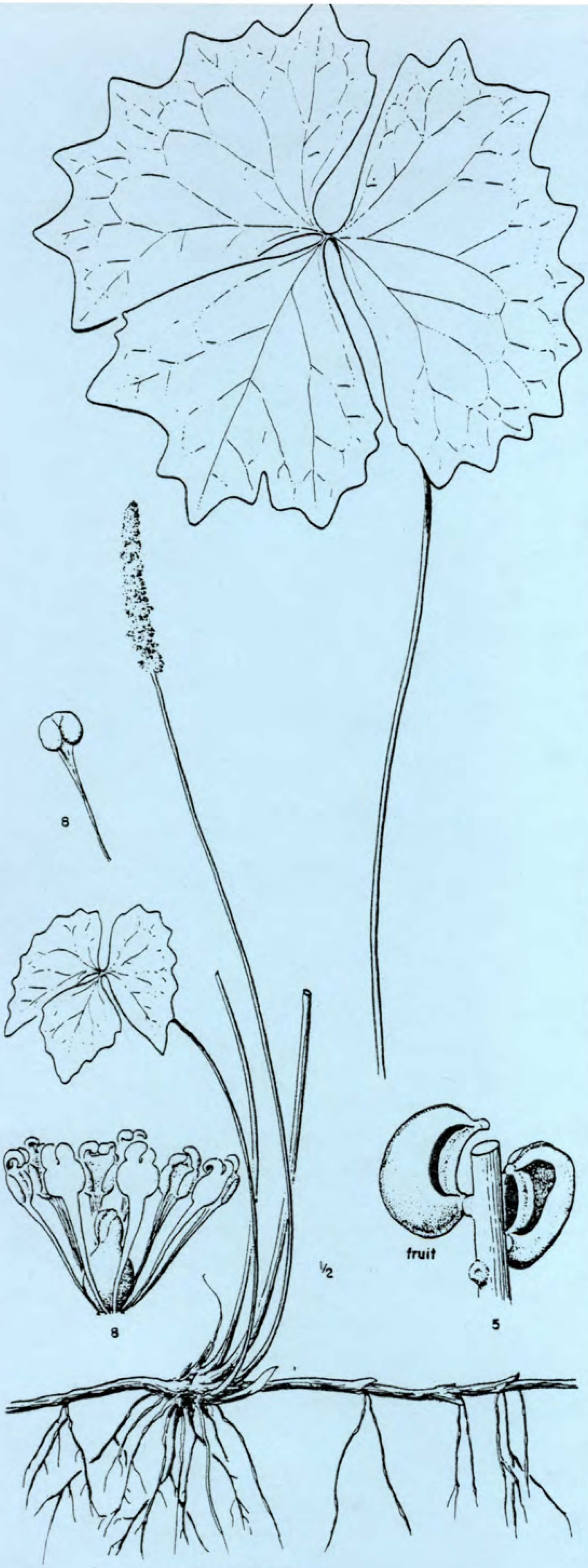
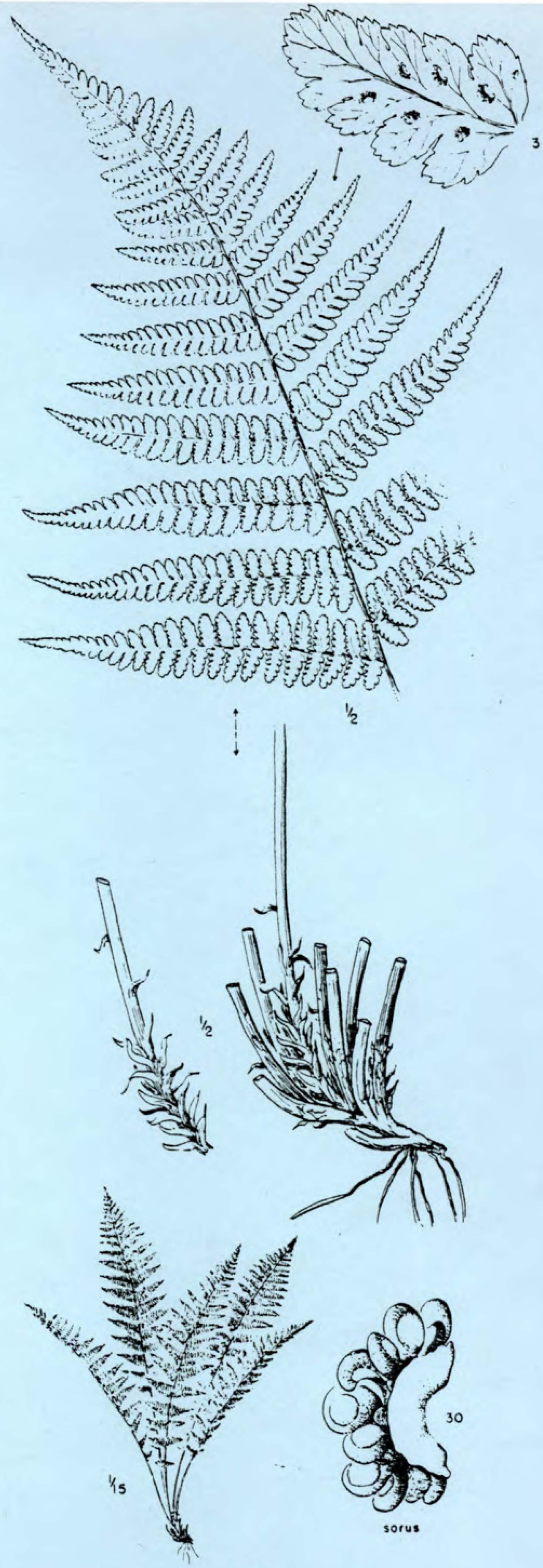


VANILLALEAF

Achlys triphylla

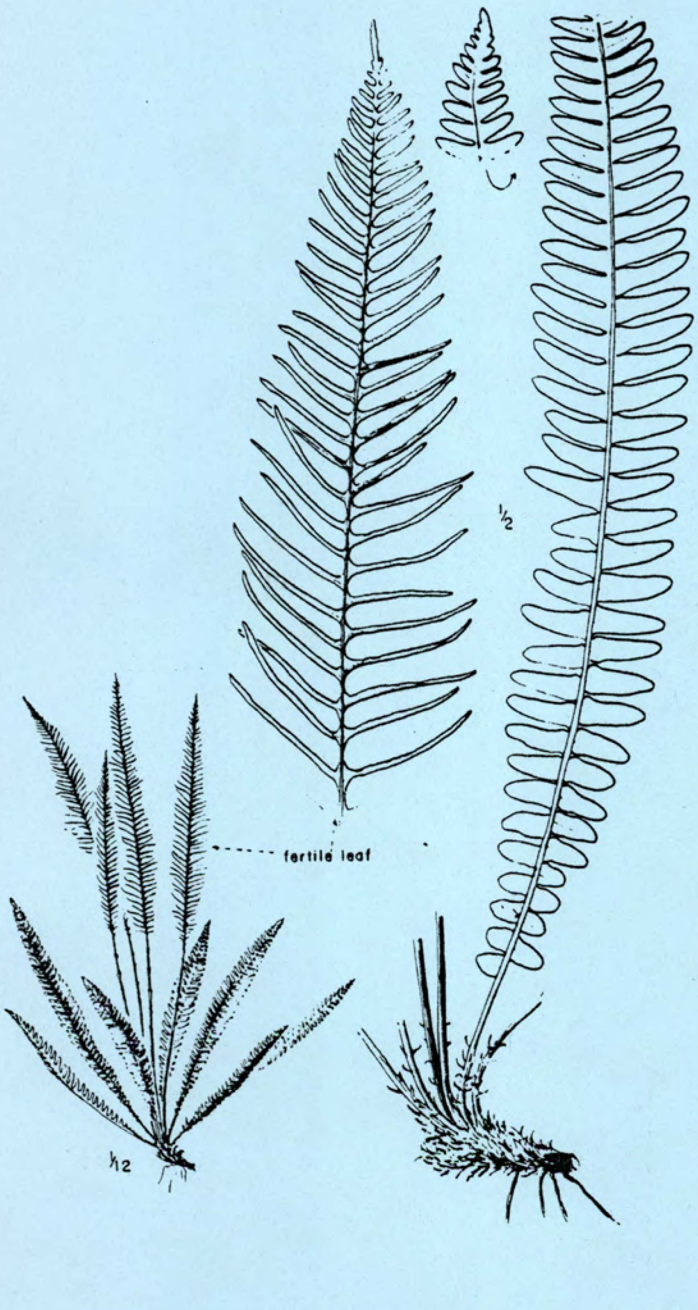
(Actr)



LADY FERN

Athyrium filix-femina

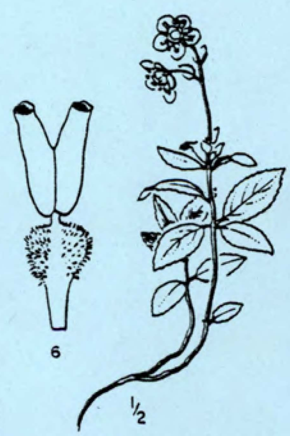
(Atfi)



DEER FERN

<u>Blechnum</u> <u>spicant</u>

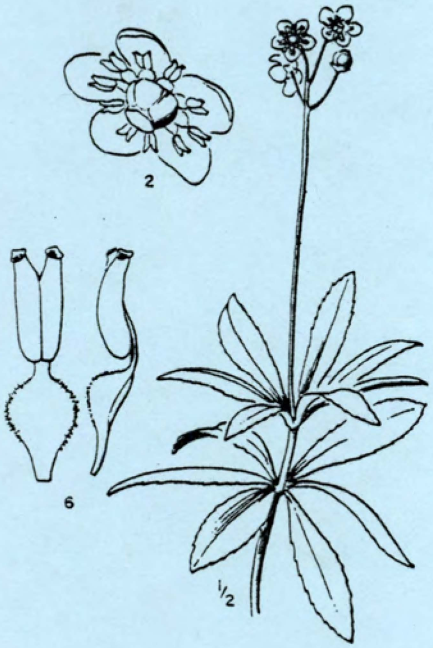
(Blsp)



LITTLE PIPSISSEWA

<u>Chimaphila</u> <u>menziesii</u>

(Chme)



COMMON PIPSISSEWA

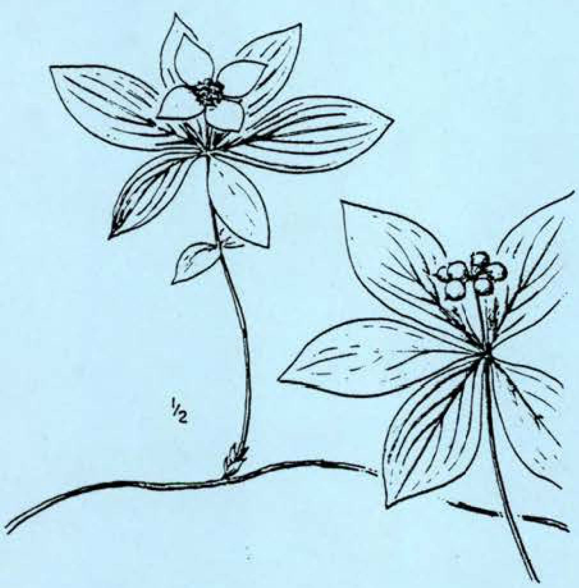
Chimaphila umbellata

(Chum)

QUEEN'S CUP

Clintonia uniflora

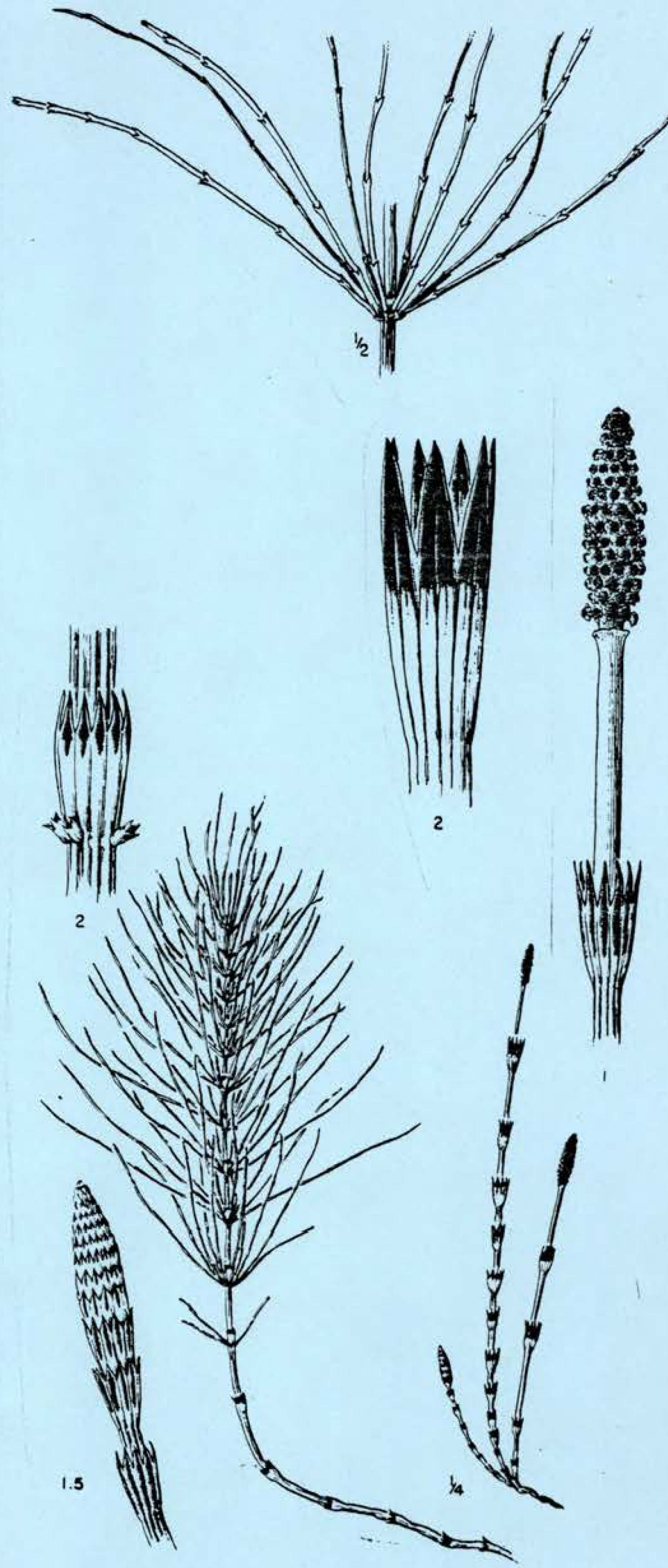
(Clun)



BUNCHBERRY

Cornus canadensis

(Coca)



COMMON HORSETAIL

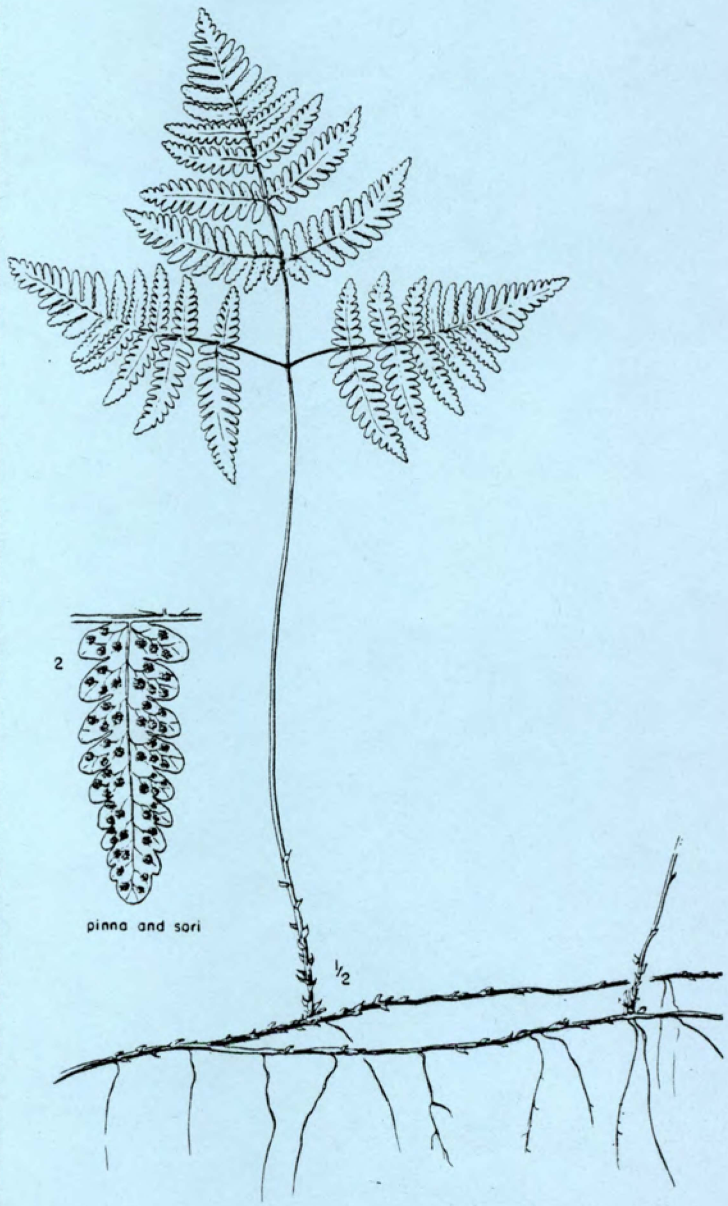
Equisetum arvense

(Eqar)

AVALANCHE FAWNLILY

Erythronium montanum

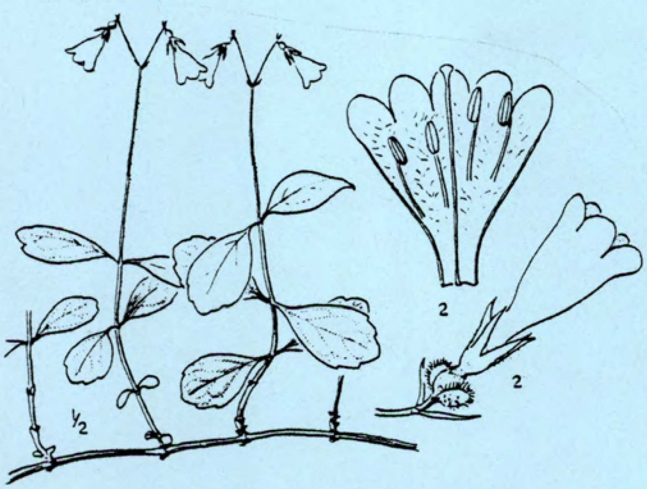
(Ermo)



OAK FERN

Gymnocarpium dryopteris

(Gydr)



TWINFLOWER

Linnaea borealis

(Libo2)

SKUNK CABBAGE

Lysichitum americanum

(Lyam)

OREGON OXALIS

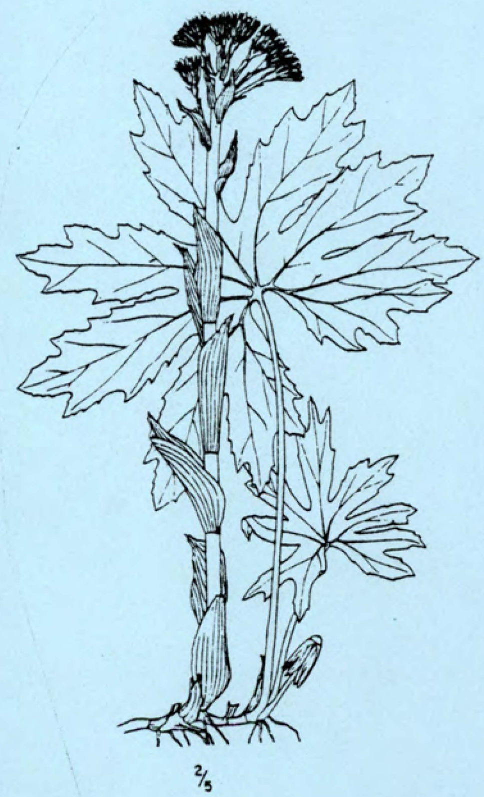
<u>Oxalis oregana</u>

(Oxor)

LEAFY LOUSEWORT

<u>Pedicularis</u> <u>racemosa</u>

(Pera)

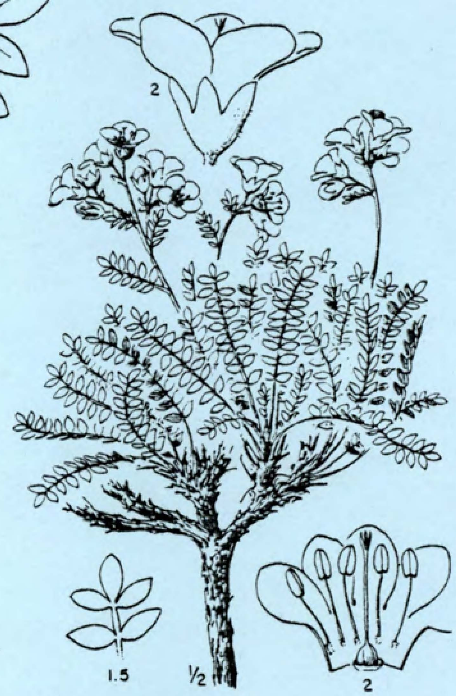


SWEET COLTSFOOT

<u>Petasites</u> <u>frigidus</u> <u>palmatus</u>

(Pefrp)

Polemonium pulcherrimum var. calycinum

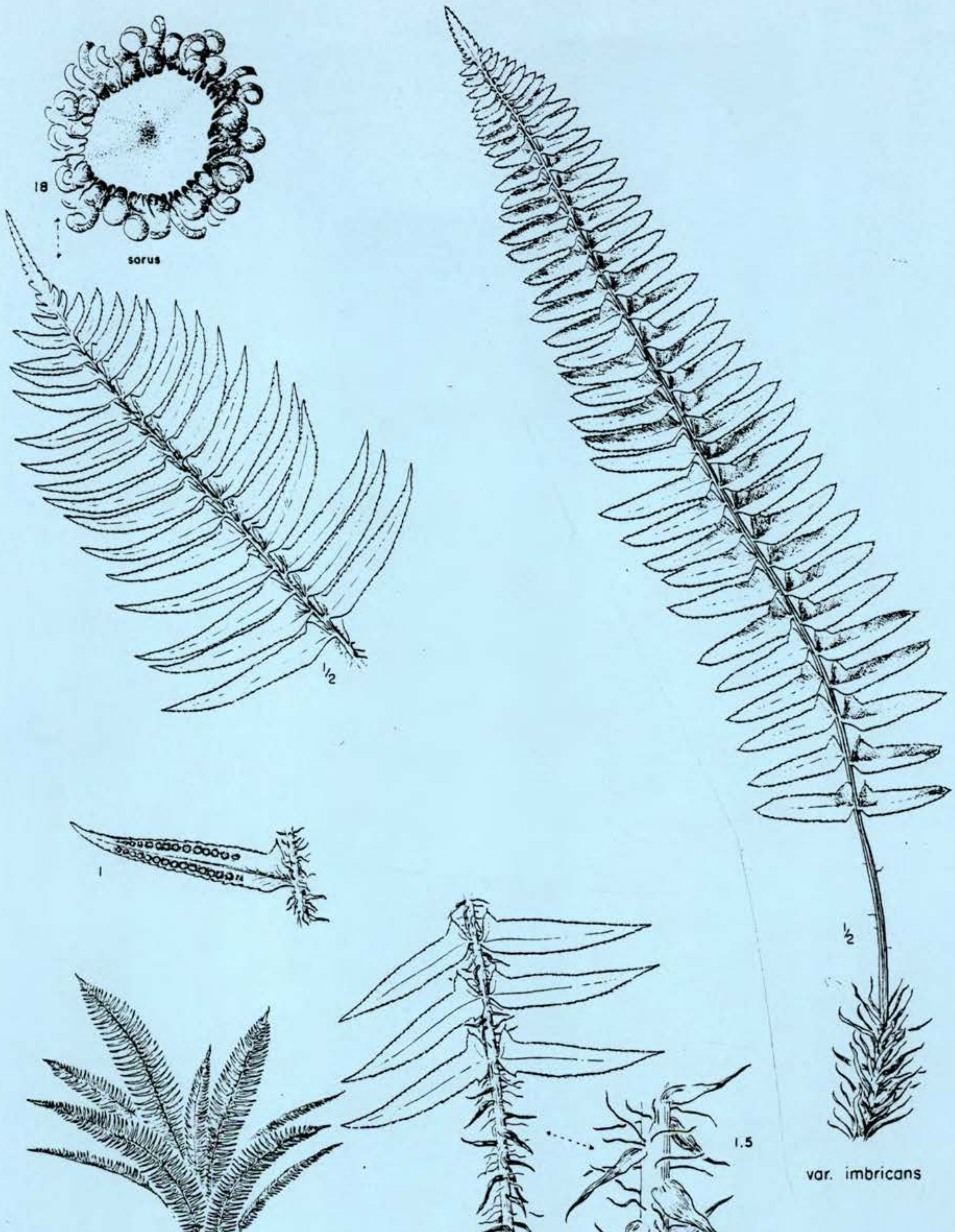


P. pulcherrimum var. pulcherrimum

SKUNKLEAF POLEMONIUM

Polemonium pulcherrimum

(Popu)



SWORDFERN

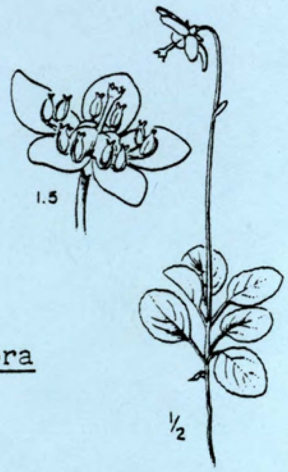
Polystichum munitum munitum

(Pomum)

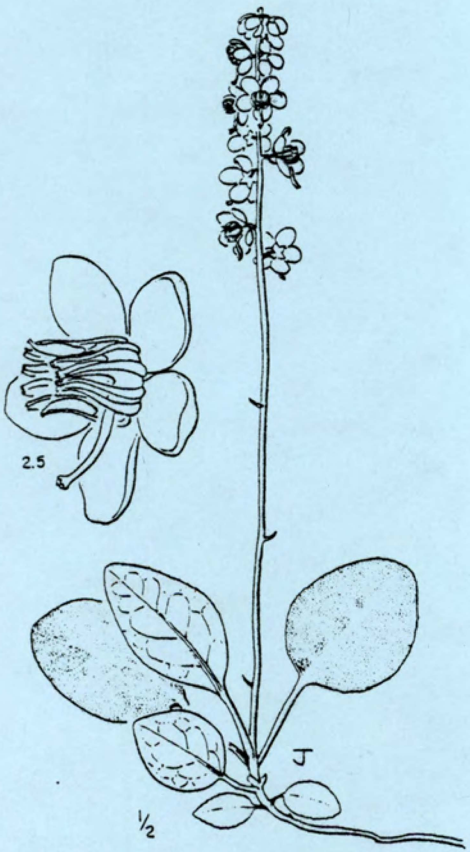
WOODNYMPH

Pyrola uniflora

(Pyun)



P. uniflora



WHITEVEIN PYROLA

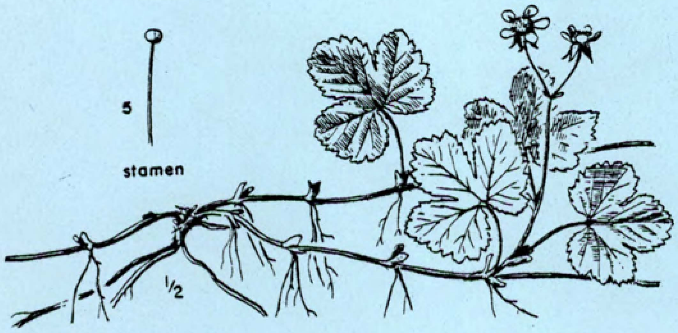
Pyrola picta

(Pypi)

ONE-SIDED PYROLA

Pyrola secunda

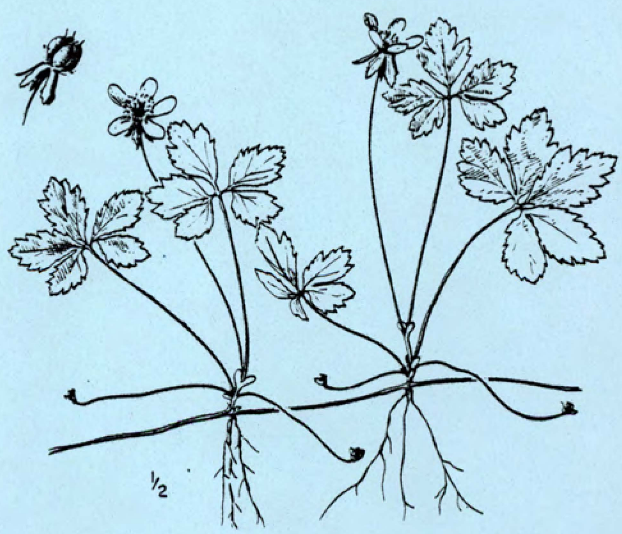
(Pyse)



DWARF BRAMBLE, TRAILING B.

Rubus lasiococcus

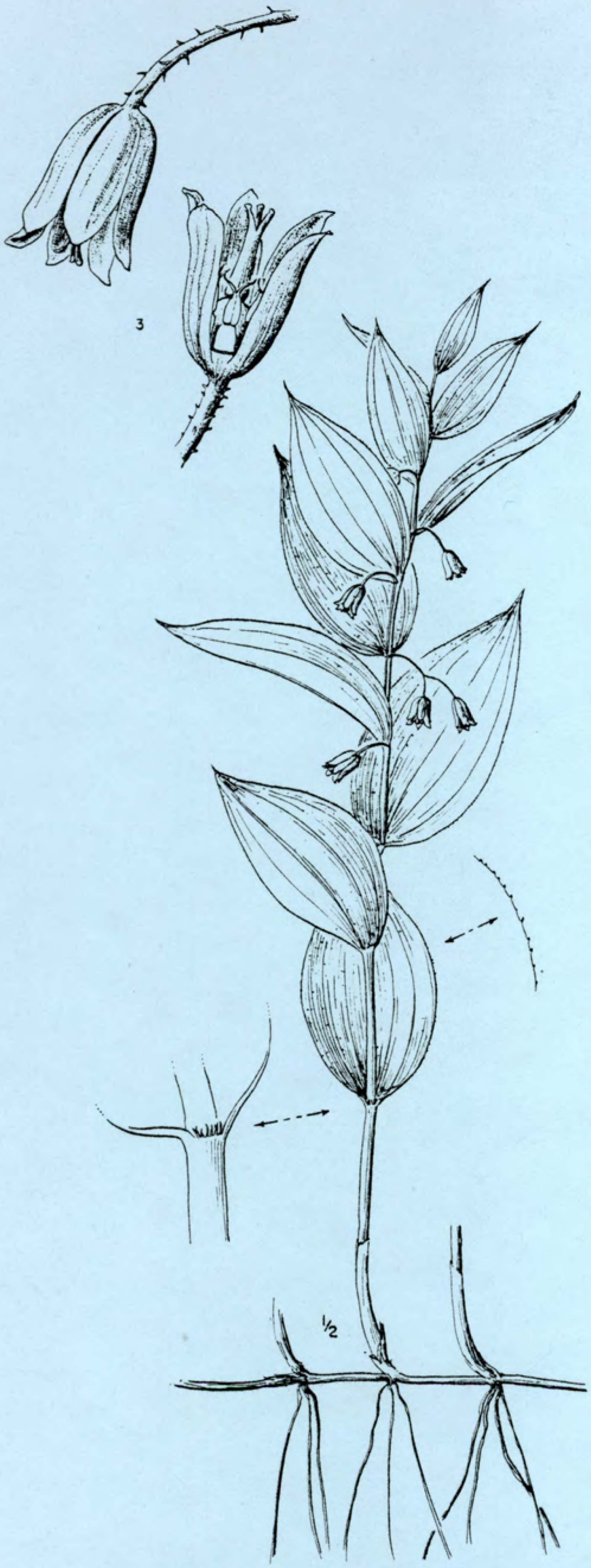
(Rula)



FIVE-LEAVED BRAMBLE, TRAILING B.

Rubus pedatus

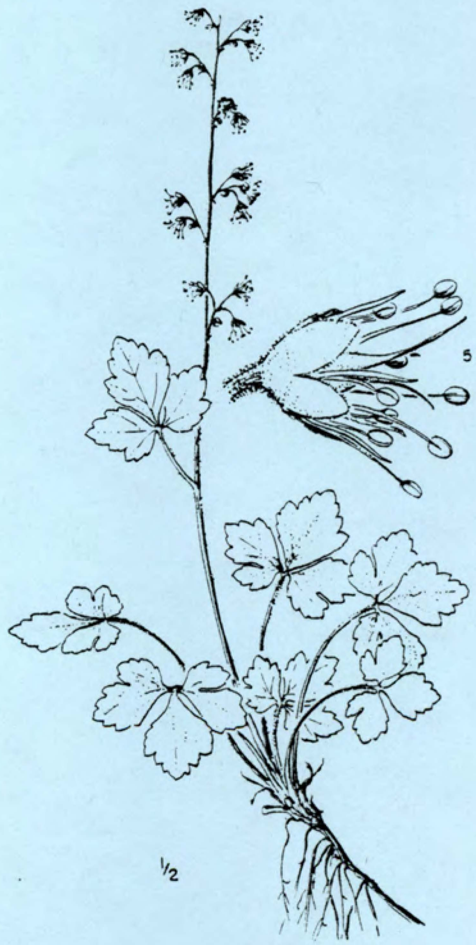
(Rupe)



ROSY TWISTED-STALK

Streptopus roseus

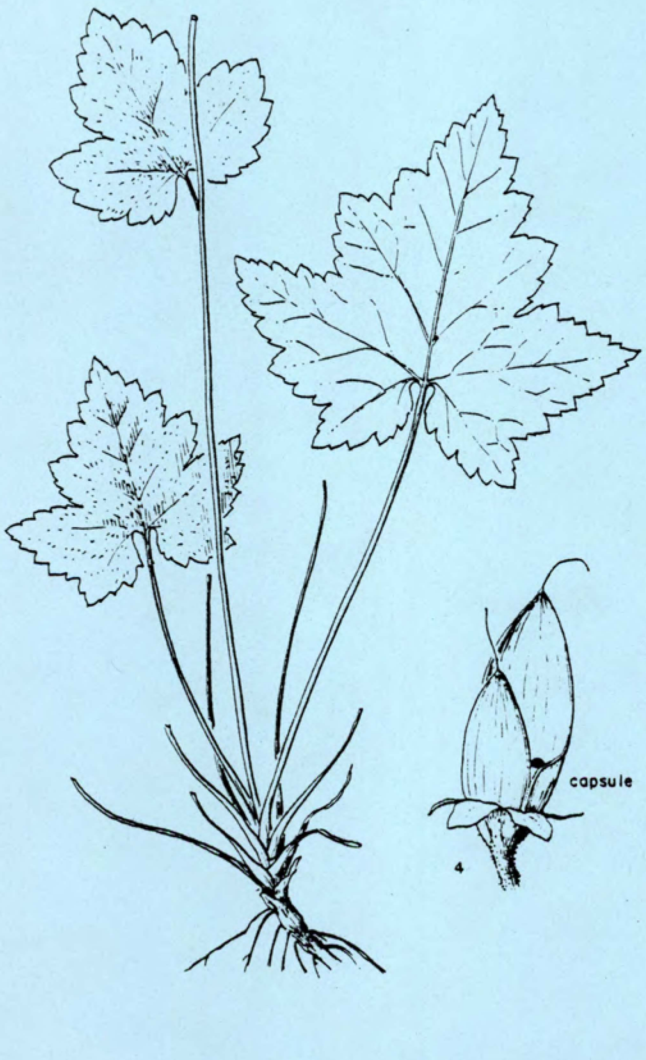
(Stro)



THREE-LEAVED FOAMFLOWER

Tiarella trifoliata

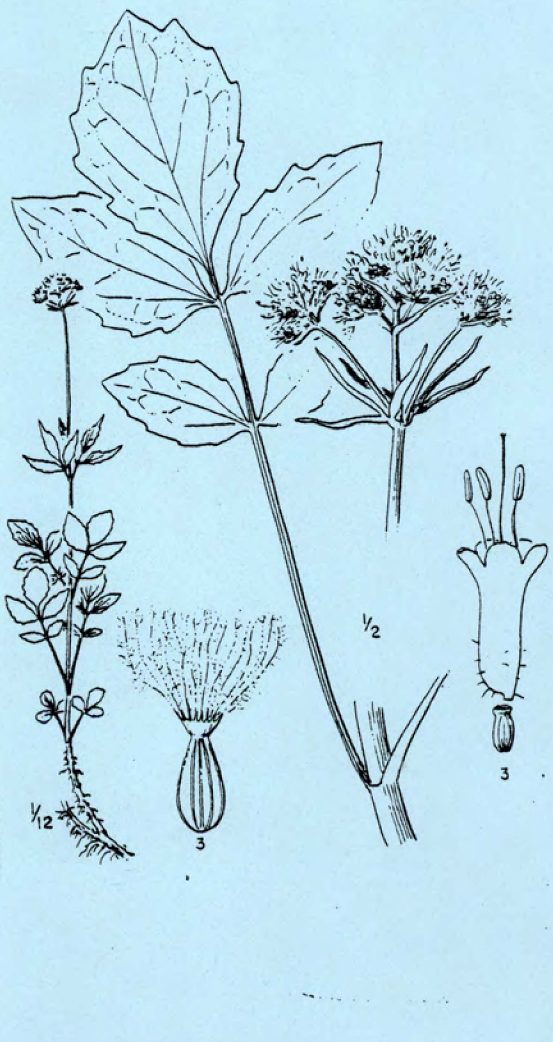
(Titr)



ONE-LEAVED FOAMFLOWER

Tiarella unifoliata

(Tiun)



SITKA VALERIAN

Valeriana sitchensis

(Vasi)

COMMON BEARGRASS

Xerophyllum tenax

(Xete)

FIELD FORM

Crew ____________		Plot			
Location ____________		Elev.			
Location ____________		Aspect			
Location ____________		Slope			
TREES					
Abies amabilis	(Abam)	Silver fir			
Chamaecyparis nootkatensis	(Chno)	Alaska yellow cedar			
Pseudotsuga menziesii	(Psme)	Douglas-fir			
Taxus brevifolia	(Tabr)	Pacific yew			
Thuja plicata	(Thpl)	Western redcedar			
Tsuga heterophylla	(Tshe)	Western hemlock			
Tsuga mertensiana	(Tsme)	Mountain hemlock			
Other					
SHRUBS					
Acer circinatum	(Acci)	Vine maple			
Berberis nervosa	(Bene)	Oregongrape			
Gaultheria shallon	(Gash)	Salal			
Holodiscus discolor	(Hodi)	Oceanspray			
Menziesia ferruginea	(Mefe)	Fool's huckleberry			
Oplopanax horridum	(Opho)	Devil's club			
Rhododendron albiflorum	(Rhal)	White rhododendron			
Ribes bracteosum	(Ribr)	Stink currant			
Rubus spectabilis	(Rusp)	Salmonberry			
Vaccinium alaskaense	(Vaal)	Alaska huckleberry			
Vaccinium membranaceum	(Vame)	Thinleaved huckleberry			
Vaccinium ovalifolium	(Vaov)	Ovalleaf huckleberry			
Vaccinium ovatum	(Vaov2)	Evergreen huckleberry			
Vaccinium parvifolium	(Vapa)	Red huckleberry			

HERBS

Achlys triphylla	(Actr)	Vanillaleaf			
Athyrium filix-femina	(Atfi)	Lady fern			
Blechnum spicant ✓	(Blsp)	Deer fern			
Chimaphila menziesii	(Chme)	Little pipsissewa			
Chimaphila umbellata	(Chum)	Common pipsissewa			
Clintonia uniflora	(Clun)	Queen's Cup			
Cornus canadensis	(Coca)	Bunchberry			
Gymnocarpium dryopteris	(Gydr)	Oak fern			
Linnaea borealis	(Libo2)	Twinflower			
Oxalis oregana	(Oxor)	Oxalis			
Polystichum munitum ✓	(Pomu)	Swordfern			
Pyrola secunda > PIAQ	(Pyse)	One-sided pyrola			
Rubus lasiococcus	(Rula)	Dwarf bramble			
Rubus pedatus	(Rupe)	Five-leaved bramble			
Streptopus roseus	(Stro)	Rosy twistedstalk			
Tiarella trifoliata	(Titr)	Three-leaved foamflower			
Tiarella unifoliata	(Tiun)	One-leaved foamflower			
Xerophyllum tenax	(Xete)	Beargrass			

PTAQ
PLAU2

Key to the Major Forest Associations of the Snoqualmie and Adjacent Skykomish River Drainages, Mt. Baker-Snoqualmie National Forest.

1. Mountain hemlock (Tsme) $\geq$ 10% cover . . . . (2)		
2. Copperbush (Clpy) $\geq$ 20% cover, Deer fern (Blsp) usually $\geq$ 20%	Tsme/Clpy/Blsp	p. 25
2. Not as above . . . . (3)		
3. White rhododendron (Rhal) $\geq$ 7% cover	Tsme/Rhal	p. 26
3. Not as above . . . . (4)		
4. Alaska huckleberry (Vaal) $\geq$ 15% cover. . .	Tsme/Vaal	p. 27
4. Not as above . . . . (5)		
5. Blue-leaf huckleberry (Vade) and/or Red heather (Phem) $\geq$ 25% cover	Tsme/Phem-Vade	p. 29
5. Not as above . . . . (6)		
6. Thinleaf huckleberry (Vame) $\geq$ 10% cover.	Tsme/Vame	p. 31
6. Total ground vegetation $\leq$ 20% cover.	Tsme/Dep.	p. 33
1. Not as above		
7. Silver fir (Abam) $\geq$ 10% cover. . . . . (8)		
8. Alaska huckleberry (Vaal) $\geq$ 20% cover.	Abam/Vaal	p. 39
8. Not as above . . . . (9)		
9. Devil's club (Opho) $\geq$ 10% cover.	Abam/Opho	p. 45
9. Not as above . . . .(10)		
10. Thinleaf huckleberry (Vame) $\geq$ 10% cover	Abam/Vame	p. 46
10. Total ground vegetation $\leq$ 10% cover .	Abam/Dep.	p. 48
7. Western hemlock (Tshe) $\geq$ 10% cover . . . . . .(11)		
11. Devil's club (Opho) $\geq$ 10% cover	Tshe/Opho	p. 55
11. Not as above. . . . .(12)		
12. Salal (Gash) $\geq$ 10% cover	Tshe/Gash	p. 56
12. Not as above . . . .(13)		
13. Alaska huckleberry (Vaal) $\geq$ 10% cover	Tshe/Vaal	p. 58
13. Not as above. . . . .(14)		
14. Swordfern (Pomu) $\geq$ 10% cover .	Tshe/Pomu	p. 59
14. Not as above . . . .(15)		
15. Foamflower (Titr) and Oakfern (Gydr) each $\geq$ 20% cover.	Tshe/Titr-Gydr	p. 61
15. Not as above		
16. Oregongrape (Bene) $\geq$ 5% cover	Tshe/Bene	p. 62
16. Total ground vegetation $\leq$ 10% cover.	Tshe/Dep.	p. 63
A. Shrubland Associations		p. 64
B. Herbland Associations.		p. 74